NEWS IN PERSPECTIVE *NOVEMBER 1, 1961*

ECONOMIC CLIMATE

OUTLOOK IS GOOD, and is getting etter. There are indications that usiness growth will be more rapid and ore prolonged than had earlier been xpected, and that worthwhile strides ill be made in reducing unemployment. he problem of joblessness will, howver, remain serious. The number of eople entering the labor force will oon start to swell, and it will take substantial and consistent economic growth just to prevent the percentage of unemployed in the labor market from reaching dangerous heights.

MOMENTUM TO EXPANSION, so far, has come mostly from private investment and from government spending. Consumers, on balance, have not been a sparkplug of recovery, though steady spending at a high level has contributed to maintaining confidence. Some inventory accumulation by manufacturers helped, too, as did an increase in the number of new orders for machinery. A modest pickup in outlays for plant and equipment—to a fourth quarter annual rate of $35.9 billion—comes close to offsetting any questions that may arise because of the consumer's relatively cautious approach to buying.

OUTPUT RISE THIS YEAR has been steep. The total of goods and services during the third quarter ran at an annual rate of $526-billion, and it may touch a $540-billion rate by the end of the year. This will be about an 8 percent rise from the 1961 starting rate of $501-billion. It will yield an actual gross national product of $520-billion for the year. In 1962, if all goes well, gross national product will move up again, and end the year at an annual rate of $575-billion or more.

MANAGEMENT VIEW

"WE'RE ALL IN IT TOGETHER . . . in a mammoth struggle that threatens every part of our industry and our traditional system of free enterprise as well," warns EEI Pres. Philip A. Fleger. "Company by company, across the land, all our people must work for the support of all the people . . . (because) a Hells Canyon, Colorado River Storage Project, a generating and transmission co-op in Indiana, a public utility district election in Washington—these are not local battles, but skirmishes in this mammoth struggle." Mr. Fleger's advice to utility top management: give the assignment and your full support to the experts in communication in our companies.

ONE MILLION-KW SIZE MACHINES have been made feasible, by recent developments in technology, for utility systems large enough to absorb the great blocks of power represented by such machines, commented Con Edison's Chairman Harland C. Forbes upon ordering one—the world's largest turbine generator—from Allis-Chalmers. Result: "substantial savings in investment costs per kw of power." The unit is part of a $131-million generating facility due for completion in 1966. (For comparison, P. S. Elect. & Gas Co.'s newly dedicated Mercer station has two 320,000-kw units costing a total of $110-million.)

WHERE NEXT FOR THE CO-OPS?—In Indiana, where 99.5-percent of the farms are now served by electricity (though three-fourths of the state's urban residents do not realize this), the $60-million federal loan to a Hoosier Co-op "goes far beyond the intent of the REA Act when it was conceived and implemented," says Carroll H. Blanchar, president of P.S. Co. of Indiana. In Florida, where a co-op has been enjoined from serving two customers previously served by Tampa Elect. Co., Circuit Judge Phillips offered his opinion that the investor-owned utility had the "pre-emptive right" to serve customers in areas where lines of the two firms were adjacent. But, in Pennsylvania, where a number of co-ops recently rescinded a commitment on a joint project with the Pennsylvania Elect. Co., Penelec's Pres. Louis H. Roddis, Jr., says: "I still believe that co-operative systems and investor-owned companies not only can, but must work together to beat back the competition of other forms of energy." (REA's Clapp is skeptical—p. 9.)

LEFTIST-TYPE GOVERNMENT PLANNERS have fashioned the Bureau of Reclamation proposal for a 115-kv line to serve missile bases in So. Dakota, charges Neil Simpson, president of Black Hills P. & L. Co. "To them, cost is no object," said Mr. Simpson, whose company is "prepared to carry the loads at a substantial saving to the Federal Government."

AGGRESSIVE, DYNAMIC EXPANSION of power supplies at a pace which fully meets the challenge of population and industrial growth in this region—this is the real Northwest story, the retiring president of NELPA asserted at the association's recent annual meeting. Frank M. Warren, president of Portland General Electric Co. denied "the unfortunate impression that the Northwest faces an uncertain power future," resulting from the prominence of current questions of Canadian storage and the California inter-tie. He stressed positive accomplishment, exemplified by the agreement between federal and non-federal public agencies and investor-owned companies to coordinate operation of the area's hydroelectric power plants —making roughly an extra one-million plus kilowatts available.

RECOVERY STARTS LOCALLY, at the "point of distress," where the electric utility is qualified to give guidance as no governmental agency or other group is, according to Connecticut L. & P.'s Robert P. Lee. At the recent annual meeting of the Public Utilities Association of the Virginias, he declared that the utility company can be objective about a depressed area it serves as almost no elected official can afford to be . . . and the utility can face the bitter truth in any situation which is impossible of recovery.

STOCK PURCHASE PLAN, joined by 82.5-percent of Carolina P. & L. Co.'s employees, "can only result in benefit to the company as a whole and to employees as individuals," commented CP&L Pres. Louis V. Sutton. (Over 1500 employees are contributing up to 4½-percent of their base salaries, while the company contributes one dollar for every three invested by the employee.)

WASHINGTON INFLUENCE

ATOMIC POWER PROGRESS is more and more in the hands of electric power companies and their industrial suppliers (as EL&P's Nuclear Progress Report demonstrates on pages 19-34 of this issue), but the Federal government remains much in the picture. Latest examples: (1) The AEC reveals it is conducting a reactor operations survey, seeking more data on performance of monitoring and control practices, more information on radiation exposure of reactor vessels; (2) the AEC proposes new procedures and regulations for shipment of spent fuels from reactors "soon ready for refueling"; and the Congressional Joint Committee on Atomic Energy is pondering a probe of subsidies to private industry (under the Atomic Energy Act of '54) to learn if they are an effective stimulant . . . to find alternative methods for encouraging the development of nuclear technology. One prominent setback now: difficulty with the hydraulic portion of the control rod system for the reactor of the merchant ship Savannah . . . delaying fueling and sea trials about six months.

CONGRESSIONAL ACTION on transmission lines for the Colorado River Project—thought by many to have left the private vs. public power situation open to solution on its merits—left no room for doubt in the mind of Reclamation Commissioner Dominy. The Congress, he said, "supported the basic concept of integrated multipurpose development and operation of our federal reclamation projects." Expected growth in the area is so great, he added, that eventual power demand can not be met by the project nor by any one private or public utility. Dominy hopes to negotiate so as to work out the "best plan for coordinated, basin-wide operations," using existing and planned facilities, both public and private. An advocate of expanded interconnection of systems, Dominy asserts that he is "willing and anxious to work with the private utilities or anyone else who has thermal generation."

CONGRESSIONAL INTENT, when solons told the Interior Department to build federally-owned transmission lines for the Colorado project unless the Secretary "finds it practicable and in the national interest to enter into wheeling arrangements with private power interests," met differing interpretations among the men who wrote the law. Sen. Wallace Bennett (R., Utah) said it "means simply that the door is not slammed shut to negotiations" between the Reclamation Bureau and the five power companies interested in the lines. Sen. John Carroll (D., Colo.) felt it would "handcuff the Bureau of Reclamation." Sen. Henry Dworshak (R., Idaho) thinks that the provision means that "the final determination will be made by the legislative branch of the government." Sen. A. Willis Robertson (D., Va.) believes that the nation is faced with a fiscal problem, and "it is prudent not to spend money for the development in the area that is not necessary." He favors the law as passed "to give private utilities an opportunity to work out a wheeling arrangement." The sponsor of this facet of the law, Sen. John McClellan (D., Ark.) said it "is designed to make sure that this whole issue is explored to the utmost."

COOPERATION BID BY UDALL, expressed in reaction to the investor-owned utility industry's 10-year program of transmission line construction, is belied by his all-out espousal of government power "seriously threatening the west's reclamation program," says Sen. Wallace F. Bennett (R., Utah). About the Colorado River Storage Project, the Senator commented: "Mr. Udall is so devoted to the Federal power lobby that he is willing to take $160-million away from irrigation projects in the four states to build disputed transmission lines."

CHARGE OF "PIRACY" of choice markets has been leveled at investor-owned utilities by REA Chief Norman M. Clapp. He alleges that "pirating of the choice loads in rural territory long served by co-op systems is reaching serious proportions." Clapp, in a strong statement concerning competition between utilities and co-ops, also asserted that coast-to-coast there is "a spreading pattern in seizure of thousands of co-op consumers by power companies hungry for the more profitable loads in the rural territories they once refused to serve." He stated that "sheer survival of the co-op is going to be threatened by the new inroads of the power companies," adding that the very success of the co-ops "has created the present crisis in rural electrification."

EIGHTH ANTITRUST SUIT has been filed by the Justice Department in connection with the so-called Philadelphia cases involving electric equipment makers. Nine firms, said to produce and sell "substantially all" U. S. insulators, are named in the suit, which did not specify the amount of damages sought. TVA is asking treble damages and double damages are sought for other government purchasers. (Then, in a counter-suit, Westinghouse sued the TVA for more than $31-million to gain compensation for alleged costs incurred in making changes required by post-contract specification modifications by TVA.) And, in the first action of its kind by the nation's regulatory agencies, the Pennsylvania Commission sought to intervene in the anti-trust actions with an eye on possible rate reductions and refunds for the state's power consumers.

INDUSTRY SIFTINGS

"HIGH PROFIT" BUSINESS?—Not the electrical equipment industry, at least in recent history, according to Line Material's Pres. R. G. Wheaton. Speaking at the recent annual meeting of NELPA, he pointed out that from 1951 to 1955, average after-taxes profit for 15 manufacturers was 4.8-percent of sales, 4.3-percent in 1956-60, only 2.8-percent in first half of '61. With a minimum profit margin for a manufacturing industry set at 5-6-percent, says the L-M head, "the profit squeeze in our industry is so acute that everyone has been forced to examine critically all elements of cost. I venture to say that all organizations are already relatively lean and tailored to make competition, rather than meet it." (Another top executive, GE's Pres. Gerald L. Phillippe, noted in making his first quarterly report as GE chief that an improved outlook for corporate earnings reflects cost controls and a lessening in "chaotic price conditions" that prevailed earlier.)

GAS TURBINE GENERATING for operation in periods of peak demand will be available to the Delaware P. & L. Co. a year from now. Announcing plans to install two units (11,700- and 12,900-kw), the utility's Pres. A. T. Gardner noted that one will utilize a "reliable" aircraft-type jet engine—"an innovation." Mr. Gardner also pointed out that installation of the gas turbines enables his company to defer previously planned construction of another 150,000-kw unit at this station—permitting deferral of contemplated common stock issuance next spring and major financing until '63.

NEW FALL-WINTER SALES BIDS are getting utility fanfare. Samples: Commonwealth Edison's "Fun-in-the-Sun" sweepstakes designed as a traffic builder for dealers promoting electric dryer sales, (with ten Las Vegas vacation awards to customers, a $29.95 wiring package, and extensive cooperative advertising as utility support). And, in the hard-hitting electric range sales campaign being conducted by So. California Edison and its dealers, the utility's Sales V-P, J. H. Mead, promises 10-million individual newspaper selling messages, more than 122-million sales impressions via full-color billboards; while silver dollars will be paid by a "mystery shopper" each time a dealer salesman uses the campaign payoff words: "it's clean . . . it's cool . . . it's economical."

DELIVERED PRICE OF COAL must be lowered, largely by more help from the transportation industry, urges Peabody Coal Co.'s V-P S. L. Jewell. He told a Southern Research Institute conference last month that "transportation costs are largely outside our power to control and noted that since 1948 the average value of coal at the mine dropped six-percent, while railroad freight rates rose 25-percent. (But, one utility—Detroit Edison—exercised new control over freight costs . . . planned a pipeline delivery, induced rail suppliers to cut per-ton charges 37½ - 50-cents in a 10-year pact applying to rail or rail-and-barge shipments.)

BIGGEST SINGLE COST: COAL, emphasizes Cleveland Elect. Illuminating Co. in a release proclaiming the advantages of its new half-million dollar automatic generation dispatching system. "Its fact-packed brain helps squeeze every ounce of energy out of every pound of coal," says CEI, "vitally important with a $22-million annual fuel bill at stake." The new dispatching system also pays off in interconnection, "because the flow of power is smoother." (CEI has an intertie with Ohio Edison not as yet with Ohio Power, as EL&P inadvertently noted in the Sept. 15 issue, page 7. But, Ohio Power is now building 345-kv intertie with CEI.)

NEW SCHOOL LIGHTING GUIDE, expected to be published by the end of the year, "will provide the nation's school boards and administrators with the 'how to' for making available better seeing conditions for our children," the new IES president James R. Chambers, has announced. IES proposes that its 100 sections and chapters offer speakers to interpret the "non-technical" Guide. Goal: correction of "sub-standard seeing conditions in perhaps 75-percent of all usable classrooms in the U.S."

ANTI-SMOG DEVICES have been installed on the first 100 of So. California Edison's fleet of 2,600 cars and trucks to control crankcase emissions. Responding to an appeal by the Los Angeles county board, the utility was the first industrial firm to adopt the "blowby" control, which was found satisfactory in the company's own tests on the device.

ATOMIC ENERGY PRODUCTS manufactured and shipped by private firms in 1960 were worth $285.6-million, an increase of 18-percent over the value of '59 shipments, the Bureau of Census reports. Net orders: nuclear reactors, $7.8-million, primary vessels and tanks, $7.1-million; control rod drive mechanisms and components, $8.6-million; heat exchangers and condensers, $10.9-million; valves, $9.3-million; and complete reactor fuel elements and control rods shipped directly for use in a reactor, $36.5-million.

ELECTRIC LIGHT & POWER'S

Nuclear Progress Report:

Experience With the First Atomic Power Projects

THIS IS THE YEAR of first multiple startup for nuclear power plants operating on utility systems in the U. S.—and the real beginning of the "age of experience" for utility operating personnel pioneering in this new nuclear era. Moreover, within the coming year, the electric power industry will have underway large-scale demonstration of all the basic reactor designs considered to have the earliest prospects of producing power from nuclear fuel at a cost competitive with fossil-fueled plants.

In 1961, the first significant months of on-the-line know-how are coming from Dresden and Yankee, at least a couple of other projects (Elk River and Saxton) are expected to achieve startup, and several more (Indian Point, Fermi and Piqua) are now anticipating criticality very early in 1962. From these key demonstration projects, first lessons in new technology applications have already added much to the capability of the technical people who are working directly on these projects.

But, the need to know information as invaluable as is now becoming available from these first full-scale atomic plants is industrywide. While significant reactor system operating data will not come from most of these early projects until next year, many first-of-a-kind problems of design, fabrication and construction have been faced . . . and in thousands of hours of testing, countless problems encountered in teaming up apparatus old and new in power plant use have been solved.

To record some of this experience for the widest possible utility audience, EL&P editors asked for how-you-did-it reports from builders and operators of nuclear power projects which are operating in '61, or will be in the next few months. On following pages, this experience is related in varying detail by principal participants.

As previously noted, experience with nuclear portions of these plants is still limited; yet, many utility men are learning for the first time how to cope with radioactivity—as it affects materials and processes, in unusual safeguards, in remote handling, in disposing of its waste products. New and sometimes unprecedented demands for accuracy, precision and reliability are testing *and teaching* more and more men in every trial.

EL&P's PROGRESS REPORT on nuclear power developments was assembled and edited by Executive Business Editor Norman H. Jacobson, who was formerly in charge of AEC technological information services for industry.

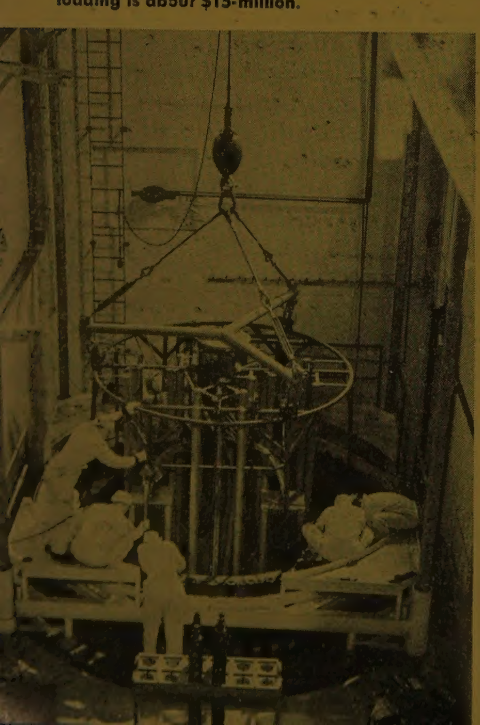
of machine and technical idea.

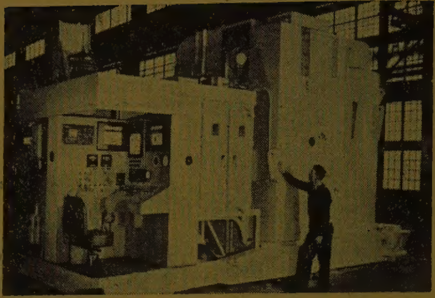
In a costly business, delays and difficulties have cost plenty—in many cases more than expected. (Example: Redesign of the supporting structure for fuel pins cost one reactor builder $500,000 and nine months effort. In another case, modification of control rod equipment, the reactor supplier's expense involved installation of an extensive facility for remote machinery at the project site—only to be abandoned unused when complete re-manufacture was finally undertaken.) But, there are instances, too, of performance beyond expectation of dollars spared, even in this earliest stage where the price of practice is highest.

In some instances, the steps taken to make new devices work well have been so successful that the performance of "proved" products suffers by comparison. The atom can be blamed, perhaps, for common problems of leakage (in valves, control rods, etc.), but hardly for such afflictions as turbine vibration and generator tube failures which have plagued some operators.

Generally, it would seem, operators and their suppliers are living pretty well with their initial nuclear age headaches. Suppliers, anxious to chalk up technical successes and win vital customer approval in these first years, are extending all possible services and expert assistance, making changes and improvements through redesign or manufacture wherever new needs arise. And, far from the least important by-product of adversity is the *extra* experience —in the case of one project, telescoping "the equivalent of several normal years" into the few months of maintenance effort involved in unscheduled outages.

Dresden reactor is designed to contain a core of about 65 tons of nuclear fuel in 488 fuel assemblies, though full power was achieved with only 452 fuel elements. Value of first core loading is about $15-million.





Fuel transfer cask car designed for Fermi Plant is $600,000 example of specialized equipment in a nuclear power plant.

The Atomic Energy Commission acknowledges the fact that, "in general it is considered preferable to have prototype nuclear power plants built on utility systems (under cooperative arrangements or with completely private financing)," as the Commission's Ulysses M. Staebler reaffirmed recently. He adds: "it is only by operation of reactors that one can achieve confidence in the technical and economic calculations which are necessary for sound evaluation of nuclear power plants. It is only in these project efforts that the developmental groups take realistic note of all of the problems associated with a particular design concept."

The AEC's requirements for licensing, cumbersome and costly as many regard them, have also called for careful record-keeping to predict and prove performance of these first plants. The most complete and exacting tests, checks and double checks are not only demanded but documented, probably far more completely than conventional plant construction and operation requires. The volumes of "Hazard Summary Reports" add to the piles of specifications and special requisitions and already fill many file cabinets in Commission and contractor document rooms.

About such requirements one pioneer nuclear power project manager says: "They have made us supersensitive on this point—in these preliminary days of development, it is important to know all we possibly can about the equipment we ar
going to operate."

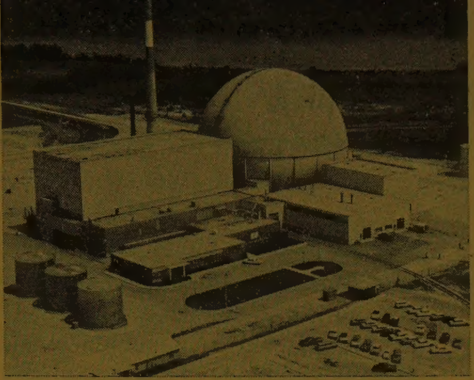
Far wiser now after several year of technical trail-blazing on the Enrico Fermi project, this nuclear specialist (PRDC Gen. Mgr. Robert W Hartwell) emphasizes two objectives which would seem to be wort more attention in the future: (1 more equitable sharing of technica responsibility for designing and constructing nuclear power projects and (2) early help for suppliers in nuclear business where many hav already "lost their shirts."

The turnkey approach taken b most of the operating systems i setting up their first nuclear powe plants does not give the same back ground usually obtained when w build conventional plants, observe Mr. Hartwell. "Then we know great deal about the product w purchase . . . and this same back

Reactor pressure vessel for PG&E's Bodega Bay Project exemplifies major new components fabricated by old-line industry suppliers.

ground is most desirable in nuclear plant construction, but seems t have been partially neglected i some of the projects. Between this position and ours—where we have built the Fermi plant ourselves have literally written our own specifications and purchased all of the component parts and materials—there should be an intermediate position that the industry could adopt as we plan our use of nuclear fuel in the future," advises the PRDC official.

About the supply situation Mr. Hartwell commented recently: "Our relations with suppliers revealed a very unhappy attitude of unrest, largely because there is not enough nuclear business. Substantial losses have resulted from lack of standardization and production volume. Such suppliers want to get into the nuclear business, they see the importance and potential of the industry and are genuinely interested—yet, they lose their shirts. In an industry well aware of the need for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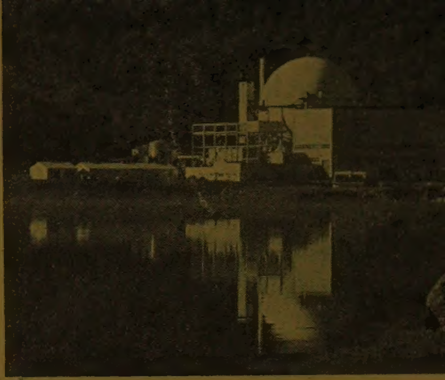
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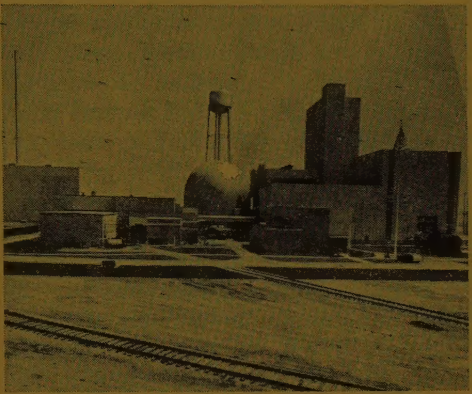
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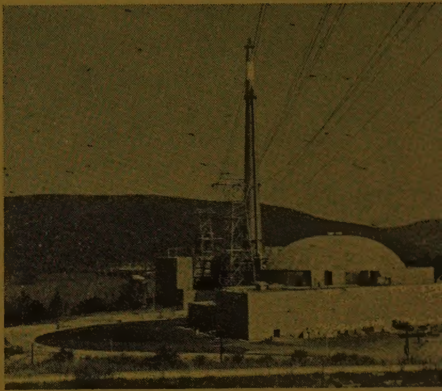
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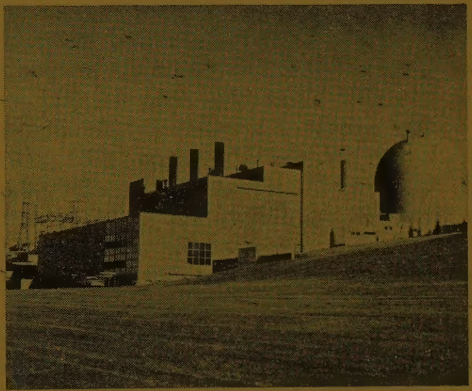
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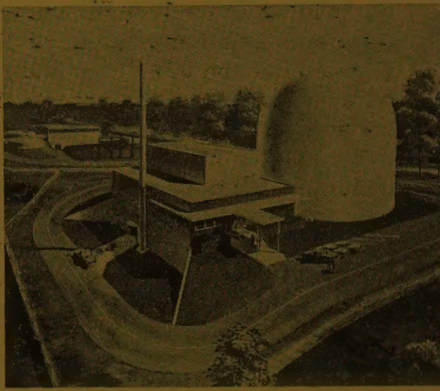
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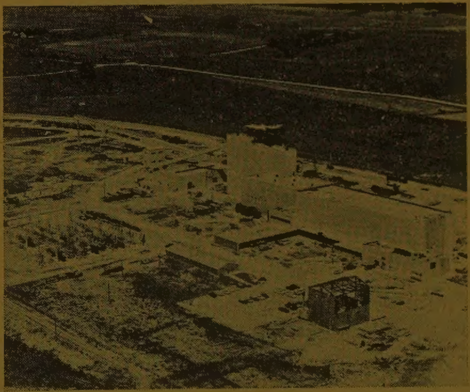
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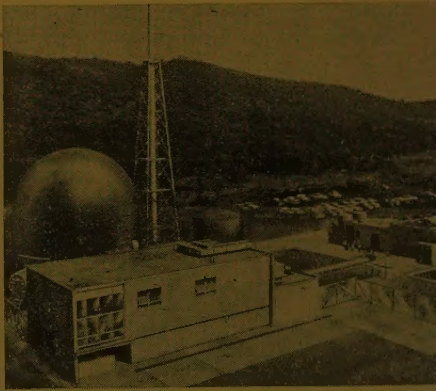
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igorous, capable suppliers, this is n illness which requires attenion. . . .”

As for the utility industry's posiion on nuclear power development enerally, for now there is no evilent intention to differ much with he AEC's philosophy of carrying ut development on a broad techical basis “in order to give greater ssurance of having the most favorble plant designs for the wide variety of nuclear power applications nd situations which are conceivble.”

Yet, as the former AEC general manager, K. D. Nichols, advised the ndustry earlier this year (in the EEI annual convention—see p. 48 of EL&P's June 1 issue):

“One of the big problems facing the utility industry is that no one of these reactor types is the obvious or final answer to the most economic power. Care must be taken that the utility industry does not scatter its support too widely. Care must be taken to insure that only the number of projects that the industry can adequately support are undertaken. There should be a follow-through on concepts well along to develop the most information and experience from them rather than jumping too rapidly to the support of promising but little-advanced projects. Also, a greater effort must be made to develop all aspects of the fuel cycle.”

Another important consideration —site selection—requires the earliest possible attention by utility companies contemplating the construction of nuclear plants. Next to the more glamorous subject of “space,” this one tops the list for attention by the hundreds who will meet later this month (Nov. 6-9) in Chicago at meetings of the Atomic Industrial Forum and American Nuclear Society.

Of course, site selection is only part of the larger problem of safety. As the Atomic Forum puts it in its advance program for the big nuclear week in Chicago, “several events of 1961 have focused the atomic community's attention on the complex problem of safety” . . . and their impact on the rate of U. S. civilian reactor progress will be evaluated in one key AIF conference session.

The Forum's President, Charles H. Weaver, vice-president of Westinghouse, sums up the appraisal of nuclear progress to date in a few words: “The payoff is knowledge.” He adds: “Today, we know that large stations can be designed with confidence. We know that they will operate safely and reliably. We know substantially what the capital costs are. And, we are beginning to learn something about the cost of the power that is produced from these first nuclear plants.”

"On System" Operating Experience Limited, But Maintenance Trains Operators at Dresden

By I. L. WADE, Administrative Engineer
Commonwealth Edison Co.

After a successful run of approximately three months the Dresden reactor was shut down on November 16, 1960, for inspection of control rod drive mechanisms. Routine tests of control drives indicated a separation of one boron steel control blade from its drive. The ensuing inspection showed that the 17-4 PH (H 900 F) tube forming the moving part of the drive had cracked circumferentially and broken off and that five others also had small cracks, but none were broken through. It was determined by many tests of the material that while its wear qualities, for which it was primarily selected, were excellent, it was sensitive to stress corrosion when subjected to the residual stresses which were found to be present in the tubing. It was concluded that if the 17-4 PH material were aged at a temperature of 1100 F instead of the 900 F that the material would be amply wear resistant and yet not subject to stress corrosion. Other changes in manufacturing to eliminate the residual stresses were also made. All drive tubes were changed to this material.

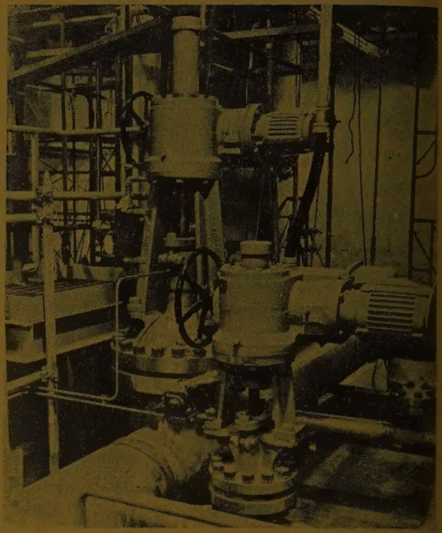
During this same outage, cracks were found in the 2-percent stainless steel control blades emanating from the welds holding the ⅜ plate in a cruciform cross-section. No blades were broken but the possibility of this happening prompted the manufacturer to replace all blades with blades of the same outside shape and dimensions but built up of ¼" OD stainless steel tubes filled with boron carbide powder encased in a stainless steel sheath.

A routine inspection of other reactor internals showed several small cracks in the 405 stainless steel grid supporting the core. The grid consists of 12 in. x 1 in. beams notched and arranged in egg-crate formation and welded at all junctions. These cracks were not of sufficient number or magnitude to warrant replacement. They will be carefully inspected during future outages.

Power Operation Resumed

The reactor was closed up and power operation resumed on May 29, 1961. Since that time the station has operated a total of 4,150 hours up to the end of August, 1961, at a capacity factor of 76-percent with only minor difficulties.

Elaborate procedures are followed to detect any separation of control blades from the drives and to detect any loss of boron carbide from the control blades. To date there has been no indication of such trouble.



Motor-operated valves and stainless steel piping are part of the secondary steam supply system installed inside Dresden steel containment sphere.

During recent months of operation, there have been a few steam leaks at valve packings which required attention and some difficulties with the equipment for filtering and treating the radioactive waste water. These problems can be solved eventually.

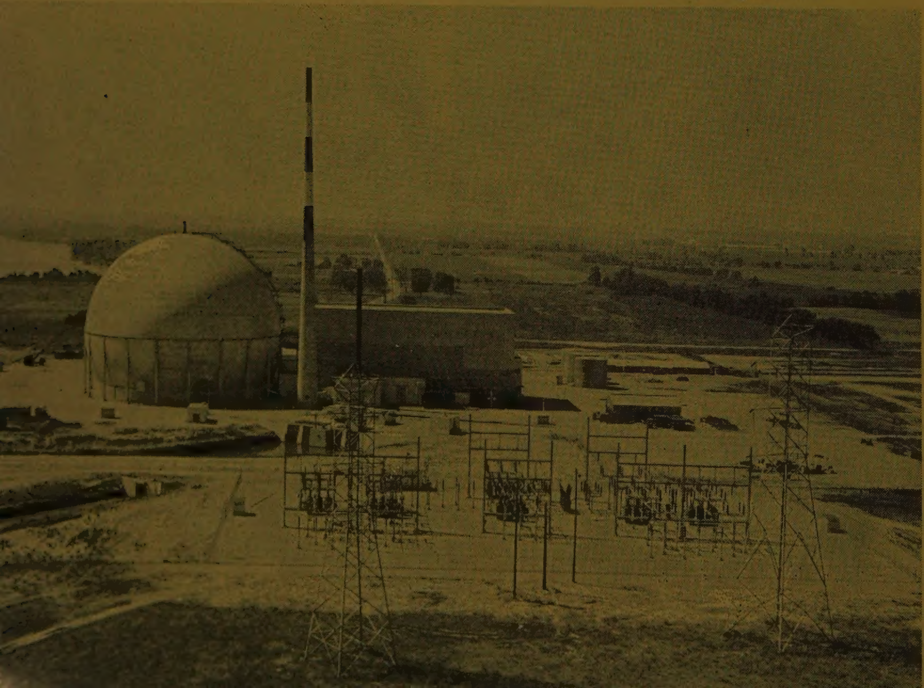
There have been indications of leakage of zircaloy clad fuel rods in two locations in the core. Leakage has been kept to a minimum by the positioning of the control blades in the vicinity of the suspect fuel bundles and a shutdown on this account is not contemplated. Radiation levels in reactor water and off-gas stack are substantially below the level that would dictate a shutdown.

The Dresden reactor control system utilizes in-core nuclear instrumentation for the first time. Mechanical damage of the detector assemblies during rework and refueling has been a problem. Mounting schemes requiring less handling are recommended for future installations, and we understand design changes are now being incorporated in newer in-core installations.

Reactivity Control Problem

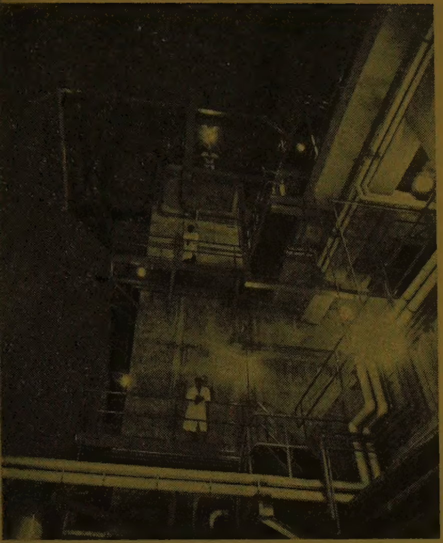
Equipment for injecting sodium pentaborate into the reactor to control reactivity in emergencies has given difficulty from leakage through valves and in keeping such high concentrations in solution. Plans are being made to change to an atmospheric tank system using pumps for injection.

Dresden site, 40 miles from Chicago, where more than 50,000 visitors have journeyed to see nation's first full-scale atomic power plant, built by the investor-owned electric power industry. Through switchyard (foreground), some 600-million kwh were delivered by August, 1961.



Dresden Operation Provides Large-Core Performance Data, Evaluates Zr-Clad Fuel

By DR. R. B. RICHARDS, Atomic Power Dept.
General Electric Co.



Dresden, world's largest all-nuclear power plant, has massive dimensions: its 190-ft steel containment sphere houses the 300-ton reactor vessel.

Performance has been noteworthy in these respects:

1. Radiation levels throughout most of the plant and containment sphere lower than anticipated.
2. Radioactive gaseous effluents levels have been only a small fraction of the levels allowable.
3. The reactor operates with excellent stability and response. There have been no turbine-generator troubles.
4. The manpower requirements are less than originally planned and some further reduction is possible.

Two long outages for redesign of equipment have limited our "on system" operating experience but have given us considerable experience in maintenance of this type of equipment. The handling and inspection of radioactive equipment and the associated contamination problems have given our personnel the equivalent of several normal years of experience.

After an outage in October to make inspections of the reactor and to make the sphere leakage tests required by the AEC, the plant was expected to be back in service by the middle of November, assuming that nothing of a serious nature is found. Thereafter, normal run until our first refueling time around the middle of 1962 is anticipated.

Vallecitos Boiling Water Reactor development programs established the basic design concepts for Dresden. However, only Dresden operation could provide large-core performance data which could not be extrapolated precisely from its smaller prototype. (Dresden first produced power in April, 1960, reached full output of 192,000-kw gross in June, 1960, and was brought into regular commercial service in October, 1960.)

The operation of Dresden as a base load unit on the Commonwealth Edison system has established these facts:

1. *Higher Power Possible.* Power flattening has been achieved through selective positioning of the control rods to compensate for flux perturbations due to void formation. With the measured power distribution the reactor was brought to full power with only 452 fuel elements of the 488 fuel elements for which the core was initially designed. Results of the power-testing program indicate a 35-percent reduction in the power peaking factor from that obtainable with a uniform reactor core. Calculated and experimental comparisons of reactivity for several core and control rod configurations were conservative for hot operating configurations, and the reactivity proved to be about 1.5 percent higher than expected. Thus, the reactivity available at the start of the fuel cycle was slightly higher than originally estimated.

2. *Reactor Extremely Stable.* Stability tests over the full range of power operation have proven the Dresden core to be highly stable not only under operating conditions but also at almost double the rated steam void volume in the core and at more than 130-percent of rated primary steam flow.

3. *Ease of Operation.* Dresden has confirmed original VBWR experience concerning ease of plant operation.

– *Turbine contamination* by the primary steam was found to be negligible at Vallecitos, and turbine radiation levels at Dresden have been far lower than originally estimated, permitting easy access to adjacent equipment areas. Reduced turbine shielding requirements will be possible in future plants.

– *Radiation levels* measured at Dresden during full load operation have presented no problems, being generally less than 2 mrem/hr in the upper shielded elevations of the sphere, and less than 6 mrem/hr in the lower shielded elevations. Gaseous wastes discharged to the atmosphere have been only about one-thousandth of the permissible 700,000 microcure per second rate.

– *Dual-cycle operation* of the system has provided excellent load following capability. The plant responds to load fluctuations from 55- to 100-percent of rated capacity without control rod adjustments.

–*Plant heat rate* was determined to be 11,600 Btu/hr, 2.5-percent lower than designed. This resulted from a higher turbine mechanical efficiency than anticipated, and reduced plant auxiliary power requirements.

4. *Fuel Performance.* Performance of prototype zircaloy-2 fuel in VBWR indicated that cladding failures could occur if water were permitted to enter the fuel operating at high heat fluxes and high central temperatures. On the basis of this experience, additional effort has been put into zirconium alloy development and alternate designs of stainless steel clad fuel.

Dresden had generated approximately 600-million kilowatt hours of electricity through August, 1961. Over this period, the peak fuel rod segment exposure was approximately 3600 mwd/t, or 36-percent of the design average. There has been some evidence that there is now one (or possibly a few) small fuel cladding defects, but no operational difficulty has been encountered. Continued operation of the reactor will provide information necessary for a complete evaluation of the use of zirconium clad fuel in BWR service.

RADIOACTIVE WASTE from Dresden was handled in nearly 15-million gallons of liquid, betweeen April, 1960 and August of 1961. These liquids were either demineralized and reused in the plant, or discharged at a controlled rate into the Illinois River. Commonwealth Edison limits the addition to the river water, so that waste discharge rates are as low as five gallons per minute. Cost is about five cents per 1000 gallons.

GE Looks Ahead: How Dresden Experience Affects Advanced BWR Designs

Based on a reasonable extrapolation of performance already demonstrated in operating systems, and on continued support by the AEC and utility industry of development programs underway, advanced BWR systems are now being designed with full confidence that major feasibility questions have been answered. General Electric can now build a complete line of advance BWR plants ranging in size from 100- to 500-mwe. Capital costs are estimated at $197 per installed kilowatt on the 300-mw plant, and $176 per kilowatt on the 500-mw station, including an assumed 10-percent for utility site costs and interest during construction.

A further example of confidence in today's advanced BWR systems was the recent decision by Pacific Gas & Electric Company to utilize a G-E boiling water reactor for its 325-mw Bodega Bay plant.

Some of the features affecting the performance and economics of these new plants are:

Increase in Plant Rating—Dresden operating information indicated our calculations on core void limits and burnout margin were conservative. The combined improvements resulting from increasing void limits and reducing burnout margin have greatly increased achievable power from both single- and dual-cycles for a given size.

The Dresden core was designed for a power density of 28 kw/liter—present cores are designed for about 40 kw/liter. This development, together with improvements in fabrication technology permitting construction of 16-foot diameter pressure vessels, makes possible design of 400-mw single-cycle and 500-mw dual-cycle reactor systems. Such increases in rating have materially reduced estimated unit plant costs, since the power output-per-ton of steel and cubic yard of concrete has increased substantially.

Internal Steam Separation—Another feature that reduces capital cost in forced-circulation plants is steam separation within the reactor vessel. This eliminates the external steam drum and its large inventory of saturated water, building structure and shielding.

Pressure Suppression—Single-cycle reactor plants (100- to 400-mw) utilize pressure suppression containment, eliminating the costly sphere and permitting a more compact plant layout which results in reduced capital cost. (The AEC has approved the use of this system for PG&E's Humboldt Bay plant. Pressure suppression is also being proposed for use at Bodega Bay.)

There still remain, of course, significant advancements to be made in the broad areas of materials, equipment performance, and fuels, and these areas are currently under attack by individual development programs. Some of the key programs now in progress include:

1. *High Power Density*—Consumers Power Company, General Electric and the AEC are supporting a research and development program aimed at developing low-cost, high power density fuel (60-75 kw/liter) capable of high burnup. Consumers Power Company will make its Big Rock Point Plant available for about 4½ years after criticality for the research and development program to be conducted by General Electric for the AEC.

2. *Fuels and Materials Development*—In these fields, both industry and the AEC have strong and active programs which are expected to yield substantial cost reduction. General Electric, for example, is developing a new fuel fabrication process wherein UO_2 powder is compacted in fuel rods by sound vibrations.

3. *Nuclear Superheat*—A basic development program on nuclear superheat is being sponsored by the AEC. In addition, the separate superheat concept will be tested in the ESADA Vallecitos Experimental Superheat Reactor, which G-E is building in cooperation with the Empire State Atomic Development Associates, Inc. The ESADA reactor will test superheat fuel designs, system contamination limits, operating and safety characteristics of separate superheaters, and integration of two reactor systems when it is later coupled to the VBWR. The current economic incentive for nuclear superheat appears to be $10-$15 per kilowatt reduction in capital costs, in addition to an estimated 0.2-0.3 mill/kwhr reduction in fuel cycle costs.

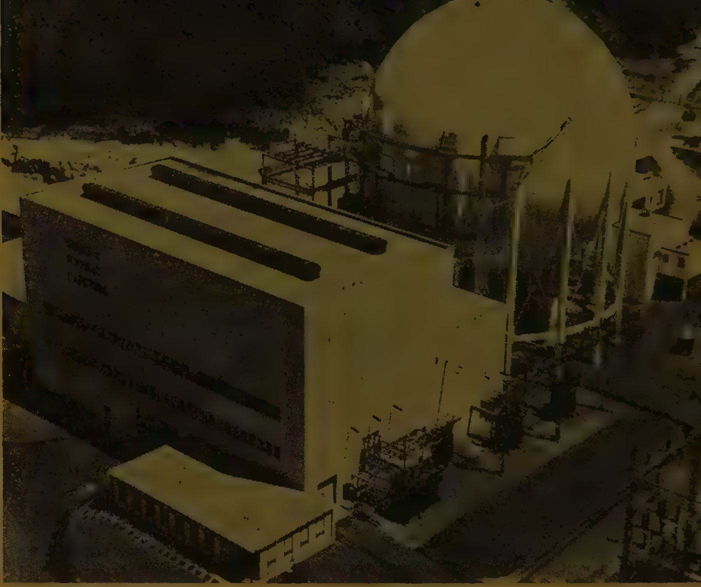
Yankee Nuclear Components Out-Perform Conventional Equipment, Promise Cost Cuts

By ROGER J. COE, Vice-President
Yankee Atomic Elect. Co.

The Yankee pressurized water reactor went critical on August 19, 1960, and electricity was first produced by the plant on November 10th, 1960. Full licensed power of 392 megawatts thermal which corresponds to approximately 116 megawatts net electrical was reached on January 17th, 1961, and test operation at this level continued until June 30. During this period the plant generated over 400,000,000 net kilowatthours of electricity.

In late June of this year Yankee's provisional license was amended to permit operation at full design power, 485 megawatts thermal, or approximately 140 megawatts net electrical, and the license was converted to a full-term 40-year license. This power level was reached on June 30th and the plant went into commercial operation July 1st.

Throughout the test period of some eight months, and in regular operation since, the reactor has performed very well. In general, there has been very close agreement between calculated and experimentally determined values for reactivity coefficients, control rod and boron worths, and power distribution within the core. These characteristics were verified by special tests made during the startup period and, in the case of power distribution, through use of the in-core instrumentation system. The in-core instrumentation system made it possible to determine that from a thermal standpoint there was a large element of conservatism in arriving at the initial core rating of 392 megawatts thermal. As a result we were authorized by AEC in the permanent license to go to the higher power level of 485 mw thermal.



Yankee plant in New England may eventually produce nuclear power at a cost comparable to the cost of power from modern fossil-fueled plants in this region its operators now predict with some experience-substantiated confidence.

With the reactor itself giving no trouble, it is somewhat saddening to report that we have had many troubles on more or less standard power plant items such as valves, flanged closures and even the turbine. Many of the packed stem leakoff valves in the 200 lb. primary system have given trouble through excessive stem leakage, even to the point of requiring plant shutdown. These troubles have been corrected now through use of stern measures such as plugging the leakoff connections and operating them as simple packed stem valves. In another plant we would re-examine this question thoroughly and might well decide to abandon the stem leakoff principle. (Editor's note: Westinghouse concedes that hermetically sealed valves are economically justified in high pressure applications.)

We have had varied experiences on flanged closures, both on the primary and secondary systems. The reactor vessel head with double self-energized "O" rings has never leaked a drop. The flanged closures on the primary side of the steam generators could not be made tight and had to be seal welded, while the ones on the secondary side were finally made tight after a considerable amount of work. Worst of all were the flanged closures on the canned motor, main coolant pumps which used a flat copper gasket. The flange faces apparently underwent distortion due to differential expansion effects when the pumps were cycled from room temperature to operating temperature of 514°F. The problem has been resolved by using lower bolt tension and not fully pressurizing the system until operating temperatures are reached.

Apparatus Performs Well

Except for this, the main coolant pumps, about which we at first had serious reservations, have given no trouble whatever with over 7,000 hours of hot operation. This is indeed a pleasant surprise. (Editor's note: Westinghouse attributes trouble-free performance to the absence of seals and bearings, which could leak.)

We are enthusiastic about our magnetic jack, latch type control rod drive mechanisms which were developed by Westinghouse with AEC funds under the Yankee R & D contract. They are a rugged, simple and relatively low cost mechanism. So far, the anticipated high radiation levels, due to deposition of activated corrosion products on the internal magnetic parts, have not materialized. The vertical steam generators have performed well with no detectable leakage from the primary to the secondary side.

There was trouble with turbine vibration during the early stages of the power testing program. We were most fortunate in being able to correct this through a rather simple modification of the high pressure turbine. The whole job of dismantling, modification and re-assembly was accomplished during a two-week shutdown in January. Since that time there have been other troubles with the turbine principally in the governing system, but these have now been satisfactorily resolved.

Under our present license, access to the interior of the vapor container is not permitted while the reactor is critical except for special test purposes. We have now determined that radiation levels within the containment sphere are almost negligible except in certain areas close to the primary system piping and the reactor itself. In view of this, we have asked AEC for authorization to enter the vapor container periodically during power operation for the purpose of making inspections and minor repairs.

We are now at about the half-way point in the estimated life of Core I. Present indications are that the core will have to be replaced some time in the first quarter of 1962. A second core, which is essentially a duplicate of Core I, both as to enrichment and

Main coolant pumps at Yankee have given no trouble in thousands of hours of hot operation —"a pleasant surprise" to operators who had serious reservations about this equipment at first.

mechanical design, has been on order for some months. Because of the long lead time for fabrication and the lack of any information on power operation of Core I at the time the commitment had to be made, it was necessary to order this duplicate core. In cooperation with Westinghouse we are now making an extensive study of improvements that could be made in Core III which would tend to reduce fuel cycle costs.

Shortly after the first of the year we expect to be refueling the reactor. We anticipate some troubles in using the fuel handling system which is complicated and which has not yet been used under water—as it will have to be at the time of refueling. We are hopeful that refueling can be accomplished in 60 days or less, but it could take longer if many difficulties are encountered. (Editor's note: Westinghouse points out that fuel handling has been made easier with the perfection of hand tools involved in the procedure.)

Anticipate Cost Reductions

By now it is well known that the capital cost of the plant was well below earlier estimates. This, coupled with the fact that fairly high load factor operation has been achieved thus far, has resulted in overall power costs being more nearly competitive than had been expected. Fuel cycle costs are reasonable, with the present core design, even with the use charge included and with plutonium credits taken at fuel value. We see opportunities for lowering overall power costs as time goes on. Some of these possibilities are enumerated below:

1. *Longer life cores.* Through the use of boron shim, plus the use of multi-region cores of cyclic loading, it appears that core lives 75-100 percent greater than is the case for Core I may be achieved with a corresponding reduction in fuel cycle costs.

2. *Operation at higher power.* At 485 mw thermal, it is our present belief that all components of the plant, including the reactor and core, are operating somewhat below their full capability. If a thorough analysis establishes this fact and operation at a higher power level is authorized, there will be a reduction in the capital cost component of overall power cost.

3. *Operation at higher load factor.* All our studies to date have been on the basis of 80 percent annual load factor. We have high hopes that even higher load factors can be achieved in coming years.

If these and other economies can be realized, it seems quite possible that the cost of nuclear power from the Yankee plant may eventually compare favorably with the cost of power from modern fossil fuel-fired plants in the New England area.

Fermi Plant Emphasizes Value of Extended Pre-Operational Testing Period

By ROBT. W. HARTWELL, General Manager
Power Reactor Development Corporation

The Enrico Fermi Atomic Power Plant, now essentially complete, is in the pre-operational test phase. During this testing process and during the final periods of construction, delays were encountered which involved the installation of systems and, in some cases, the replacement of equipment. It was necessary to extend the construction permit for a full year, and current problems now indicate it may be necessary to delay criticality beyond December, 1961.

Non-nuclear Testing

The aim of the non-nuclear test program was to prove out the acceptability and performance of all systems and components prior to fueling the reactor. Ten months ago the primary coolant system was filled with sodium, and since that date complicated mechanisms such as the rotating shield plug, fuel-handling mechanism, control-rod drives, and sodium pumps have been tested through their complete range. Service systems providing primary and secondary sodium argon cover gas for the sodium and waste disposal systems have also been tested.

One severe test on the reactor vessel and primary system involved carrying the temperature to 1000 F for a period of approximately one week. This temperature is in excess of the maximum operating condition. While at this elevated temperature a safety rod was operated and the fuel handling mechanisms were checked for proper positioning and clearances. The sodium system in general has performed satisfactorily. One of the primary sodium pumps has more than 2,500 hours of operation and has been tested up to maximum flow of 13,100 gpm. All three pumps have been operated and have been paralleled.

Graphite Difficulties

An unexpected problem developed during the 1000 F test when substantial portions of carbon dioxide gas baked out of the canned graphite in the rotating plug and escaped through vents into the argon cover gas. The carbon reacted with the sodium surface to form a crud that gummed up the mechanical devices, interfering with their operation. These carbonates are slightly soluble in sodium, and it was possible through repeated washing operations to free up all of the mechanism and to cold trap the impurities from the sodium system. Since the system has now been outgassed at a temperature considerably above that expected during the operation of the reactor, no additional release of carbon dioxide is anticipated at the normal operating temperatures which are less than 800 F. Tests are now being run to determine the possible small gas releases produced through the action of radiation on the graphite.

A second graphite problem was noted following the 100 F test. This difficulty involved the graphite shielding which had been installed in a six inch layer immediately adjacent to the reactor vessel. Borated graphite blocks six inches square were used in the erection of this layer covering the lower reactor vessel and about two thirds of the upper vessel. The material in this layer was specified as and presumed to be a high quality graphite which should be satisfactory for the purpose intended. It had not been disturbed in the previous graphite removal operations. Upon re-entering the primary shield tank upon completion of the 1000 F test, it was noted that the insulation and lagging on the vessel had bulged out several inches n some places. At these points that nsulation and lagging was removed, and it was found that the graphite layer next to the vessel had deteriorated badly. An extensive study of this condition has been conducted during the last two months. It now appears that the material used was unsatisfactory and that high-grade graphite will perform in accordance with the needs of the system. The replacement of this material in the confined space and with sodium held at temperatures from 300 to 500 F is most difficult.

Earlier difficulties involving the clearance provided in the graphite shield around the reactor vessel for vessel and piping expansion, coupled with the current borated graphite layer difficulties, necessitate the removal of almost all of the graphite shield inside the primary shield tank. This replacement is estimated to cost approximately $700,000 and may take six months to accomplish.

Interior of reactor containment building at Fermi plant, as it appears during pre-operational testing by the Power Reactor Development Co.

Fuel Pin Support

More than two years ago during testing of the uranium-molybdenum fuel pins, it was noted that the pins deformed under operating conditions of temperature and flow. The number of supporting wires along the length of the pins was determined to be insufficient. To maintain the proper pin position within the subassembly can, it was necessary to redesign the supporting structure. Following detailed design effort, a grid structure consisting of 17 honeycombed sections was selected. Due to the addition of the many supports, the pressure drop through the core has been increased, and, therefore, the potential reactor rating for the first core design, referred to as Core A, has been reduced approximately 30 percent. This redesign effort took about nine months and represented a cost to the project in excess of $500,000.

Steam Generator Tube Failure

Three once-through steam generators are installed in the Fermi Plant. These units, which are designed to transfer heat from nonradioactive sodium to boiler feedwater, have 1,200 tubes each 78 feet long in each bundle. The tubes are bent in a serpentine shape and are then nested in banks of eight. Each of the 150 tube banks in turn formed into an involute plane. Recent hydrostatic tests of the No. 2 steam generator disclosed tube failures which appear to be localized in one 60 degree section of the bundle. Current investigation indicates that these failures which originate on the inside of the tubes in the bend regions are caused by stress corrosion cracking. The steam generators, including the tubes, are fabricated of 2¼ chrome 1-percent moly material. The No. 2 bundle has been returned to the fabricator to facilitate additional tube removal and examination.

The No. 3 steam generator is now being tested at elevated temperatures and pressures. It cannot be stated with assurance what has caused the failure in the No. 2 steam generator.

Remote Maintenance Equipment

During the pre-operational test period, the operators have used specially designed remote maintenance equipment to remove a test bundle from the No. 1 heat exchanger tank and to install the permanent IHX bundle. This operation was accomplished with the sodium at 500 F and under an argon gas cover. While many minor difficulties were experienced in using the large equipment valves and flexible bag type tank, the feasibility of the design was proved and necessary modifications are now being made. This type of operating experience is invaluable prior to the fueling of the reactor.

Much has been learned during this test period, all of which emphasizes the value of an extended pre-operational testing program in the building of a first generation prototype reactor. The lessons learned are also providing valuable information in nuclear technology which should permit further advances in the development of power reactors in general and fast reactors in particular.

View of Fermi plant site shows Detroit Edison Atomic Information Center in foreground. Opened three years ago, the Center has had more than 100,000 visitors.

Operators Attest: Indian Point Reactor Is As Safe In Design, Construction As in Basic Concept

At the Indian Point generating station 24 miles north of New York City on the Hudson River, the Consolidated Edison Co. is now only months away from initiating the first large-scale commercial application of nuclear-generated steam with conventional superheat used in the production of electricity. The Con Edison reactor is a pressurized water type.

To make this station as competitive as possible, efforts to reduce construction and operating costs at Indian Point rely largely on two important features: (1) utilization of the latest techniques for conventional superheating of the reactor-produced steam, and (2) improvement of neutron economy of the reactor core by introducing fertile materials, some of which will absorb excess neutrons and be converted to fissionable material, thereby acting as fuel and prolonging the productive life of the core.

Con Edison expects to operate Indian Point as an integral part of its interconnected system of 13 generating stations and transmission lines. On such a system "unpredicted and transient load conditions can, and do, occur. In designing Indian Point station, the utility's philosophy has been to have . . . the station play its part and carry its share in the total generating system. To enable the reactor to fulfill this role, we have designed the reactor and its control system to meet a 50 megawatt (50,000 kw) instantaneous or 25 megawatt (25,000 kw) per minute electrical load change."

The benchmark for operating Con Edison's reactor is "a constant steam pressure during steady state operation." The reactor can be adjusted either automatically or manually to adjust to changes in steam pressure.

"The reactor can be under the manual control of the operator at any time. It must be under the manual control of the operator in start-up and in operation below approximately 15 percent of rated power. The automatic plant controller can only be used when the reactor is at or above 15 percent of rated power and then only at the discretion of the operator."

The reactor control system "provides the means whereby the plant operator can exercise control of the reactor to maintain a constant boiler pressure. In the case of the Indian Point reactor the end effect of over-control or of operation at too high a power level is an increase in boiler steam pressures and conversely the result of undercontrol or operating at too low a power level is a decrease in boiler steam pressure. This is true whether the reactor is being controlled manually or by the automatic plant controller. The plant operator has several methods at his disposal to correct imbalance between turbine demand and boiler steam supply. The operator can raise or lower generator load thereby shifting this load to some other generator in the Company's system, or he can raise or lower the reactor load or he can limit the maximum generator load."

Indian Point station will operate as an integral part of Con Edison's interconnected system of 13 generating plants. ConEd expects Indian Point "to play its part and carry its share in the total generating system."

"Extensive" Experience Needed

Con Edison ordered all major components from companies having "extensive experience in the manufacture of high-pressure equipment" and with "established reputations for excellent quality workmanship." All essential components were subjected to tests and inspection. Alternate power supply and equipment and an intricate system of interlocks assure the safe and continuous operation of all essential functions of the plant.

Babcock & Wilcox is responsible for the overall design of the reactor (including the core and controls) and the primary loop system, other than the coolant pumps, and for writing specifications for the components of the reactor and primary loop system; B&W is also responsible for supplying the reactor and major components of the primary loop system, and that this equipment shall be, and shall perform, in accordance with the specifications.

Of the two available fertile materials B&W chose thorium instead of U-238 from which plutonium is obtained by conversion. Thorium converts in a reactor to fissionable fuel in the form of U-233. "U-233 is much better suited than plutonium for use in a thermal reactor because of the greater number of neutrons made available as a result of each neutron absorbed in the fuel." B&W was convinced "that a reactor of the pressurized water type using thorium could be designed to be safe and reliable." In addition to the inherent stability of pressurized water reactors, due to the characteristics

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Editor's Note: This description of the Indian Point station is based on testimony offered by Con Edison and its suppliers in the AEC hearing on the final design of the facility, which was approved by the AEC on August 4, 1961.

wo of the four nuclear steam boilers for Indi- na Point Reactor can be seen through hatch. his hatch will be sealed during operation of eactor fuel delivery—scheduled for December. riticality is scheduled for early 1962.

f the water moderator, it became lear as research and development roceeded "that this reactor, as de- igned, contains another and more owerful factor for inherent con- rol; namely, the power Doppler co- fficient of thorium."

The emphasis on safety of design mplies not only the adoption of a eactor concept containing strong nherent safety characteristics, but lso "includes insistence upon de- ign of the reactor with ample mar- ins of safety. These criteria have equired a detailed knowledge of ower and neutron flux distribution, which was obtained by the expendi- ure of much time and effort, both heoretical and experimental. The ame insistence on safety required areful design consideration of all omponents of the reactor and ex- ensive test and experimental work, o prove the compatability of mate- ials in the operating environment and to verify the functional opera- ion of components. In general, the bjective was to make sure that the eactor was as safe in detail design and construction as in basic concept. We believe this objective has been attained."

Inherently Safe Control

During operation of the reactor it will be controlled by 21 movable ontrol rods made of hafnium. The drive-rod shafts for the control rods ass through seals in the bottom of he reactor pressure vessel. "The ortion of the drive shaft in the buf- er seal is chrome-planted, precipi- ation-hardened stainless steel, nown as 17-4 PH, age-hardened to 1100 F." It is not physically possible to separate sections of the drive shaft "unless there is a complete fracture once the reactor internals have been installed."

The control rods are designed to be inherently safe. The maximum upward movement of the control rod is determined by an electric motor drive mechanism or carriage. The control rod positioner is forced upward against this mechanism by hydraulic pressure, greater than the internal pressure (1485 psi) of the primary coolant water. Loss of the hydraulic pressure to a rod means that the pressure of the coolant will force the control rod down into the reactor. The valves in the hydraulic cylinder for each rod are held in position by another electrically powered valve. Loss of power to this valve causes the reactor to scram. Tests show that the control rods begin to move downward within 25/1000ths of a second after the electric power is removed from the control valve. Over 95-percent of a complete scram is accomplished well within 2.3 seconds.

In fuel handling and transfer all radioactive components, "including irradiated fuel elements and reactor vessel internals, are remotely handled in borated water so that there is a minimum of 10½ feet of water over these components at all times. This is more than adequate shielding to protect personnel." The plant has extensive equipment for removing radioactive materials from liquid and gaseous wastes. Any of these wastes discharged at the site will be in accordance with AEC regulations. Solid wastes incidental to operation of the reactor will be "shipped from the plant site for off-site disposal in compliance with AEC regulations."

The final design of the superheater, supplied by Foster Wheeler, incorporates a conservative engineering approach to all of the known operating conditions. This unit is designed for 25 ins-H_2O positive pressure on the gas side for pressurized furnace operation and 500 psig on the steam side. The steam enters both sides of the inlet header at the front of the furnace and travels downward, in parallel paths, in the front and roof-rear walls to the intermediate headers at the bottom front and rear of the unit. The steam in each superheater is internally mixed several times and is ultimately mixed together before it goes to the turbine. All the heat absorbing tube elements in the superheaters are of alloy steel with the wall thicknesses based on a conservative estimate of the metal temperature.

The AEC was assured in testimony that both the employees at Indian Point and the general public are protected from the radiation hazard resulting from the release of fission products from the reactor by four lines of defense: (1) the fuel cladding, (2) the primary system, (3) the containment vessel, and (4) the biological shield. This conclusion is based on an analysis of various conceivable incidents during reactor operation to determine the likelihood of breaching these four lines of defense. . . . The Commission in approving the containment for this project has stated 'that the hypothetical accident postulated by the applicant is of greater severity than one would reasonably expect from the maximum credible accident to the facility'."

Conventional equipment at Indian Point include this tandem-compound, double-flow, 1800-rpm machine with an estimated gross operating capacity of 275,000 kw. Reactor and its auxiliaries are designed for a thermal capability of 585,000 kw and will produce 2,200,000 lbs/hr of saturated steam at 405 psig and 449 F.

Elk River Reactor Demonstrates Design, Electrical Integration With Plant

By ELDEN J. WELSH, Manager Nuclear Contracts and Engineering Dept.,
Rural Cooperative Power Association

Although criticality of the Elk River Reactor has not as yet been achieved, there are various areas of design and electrical integration with a conventional plant that are worthy of comment.

For example, the arrangement locating the control rod drives beneath the reactor pressure vessel permits removal of the reactor head without manipulation of the control rods. It is particularly useful for reactor start-up during which time the entire low power program may be carried on without the reactor head being secured to the pressure vessel. The location of the rod mechanism should further facilitate refueling . . . the time of which is estimated to take 4 days.

The manual control of the reactor is obtained by 13 cruciform control rods that are driven up and down within the shroud. The control-rod drive is a rack-and-pinion mechanism, the pinion being connected to a gear motor through a magnetic clutch. When the control rods are raised the absorber in the upper portion of the rod is pushed out of the core by the follower section. This increases reactivity and, consequently, the power output. De-energizing the magnetic clutch allows the absorber to fall back into the core and shuts down the reactor.

At this site 30 miles north of Minneapolis, the Rural Co-op Power Association will operate the 22,000-kw Elk River nuclear power plant as part of a power supply for an interconnected transmission network.

Automatic Reactor Control

The 12 control rods and the regulating rod are manually positioned until the operating power level is reached. The regulating rod is then switched to automatic control and the other 12 rods are adjusted so that the regulating rod is in the mid-position of its range. As the regulating rod is automatically withdrawn with time after startup, the 12 rods are manually positioned to keep the regulating rod within the proper operating range.

The automatic control system which integrates the reactor and the turbine generator plant is a dual system consisting of two interconnected loops. One control loop maintains primary steam pressure at the predetermined value for a given load through the adjustment of the regulating rod. The second loop holds a uniform steam pressure at the turbine throttle valve by varying the governor valve position. Coupling between primary and secondary systems is effected by introducing signals into the secondary system whenever the primary pressure set point is changed. This provides anticipation action which takes advantage of the system capacity and acts to reduce the overall response time to the required load changes.

Both primary and secondary pressure set points are biased by a signal of unit frequency, which assists the plant to participate in electrical grid load changes. In the event of a high separation of the generator from the grid, an interlock is provided which prevents the governor motor from further opening the valve.

Source Of Station Power

The RCPA 69 kv bus at Elk River is a firm bus that is firmed up by four major transmission lines each of which is provided with a separate right-of-way over substantially different routes throughout our area. These lines radiate from Elk River to each of the four points of the compass. Through these various lines, RCPA is interconnected at three points with a private power company and at one point with the Bureau of Reclamation.

In addition to these interconnections, RCPA also has five additional plants available throughout their system for operation as well as numerous interconnections with some of the major municipalities in their service area. These interconnections and ties with other plants and municipalities contribute considerably to the stability and firmness of RCPA's transmission network. In addition to the four major transmission lines radiating from Elk River, we also have two additional steam-driven generators of 11.5-megawatt capability . . . each being connected to the Elk River 69-kv bus. Both of these units augment the transmission network.

Auxiliary Power Reliability

As in the case of any good plant design, the Elk River plant electrical layout recognizes that, regardless of design level, individual components of equipment such as cables, breakers, substations, buses, and the like, can become faulted and must necessarily be removed from service. These faulted devices, in the case of the RCPA plant, can be removed from service in four to eight cycles. In some cases these faulted sections or devices may provide the source of supply for various items of nuclear plant equipment. By the use of extensive and well-coordinated system of automatic transfer, the faulted section is quickly eliminated and a new source of supply for reactor auxiliary is obtained from a different source. All of these functions, including clearing the fault and transfer to a new source of supply, is performed in 20 to 25 cycles.

In summary, the operation of the controls for the reactor is provided in such a manner as to be completely independent of outside influences. On the other hand, reactor auxiliaries such as boiler feed pumps, and superheater fans, are guarded against permanent interruptions of service.

easibility, Reliability of Tag-On Reactor ill Be Tested in Elk River Project

J. J. DICKSON and J. H. BLACHLY
Allis-Chalmers Mfg. Co.

The primary purpose of the Elk iver Reactor Project (designed nd built by Allis-Chalmers as part f the Atomic Energy Commission's ower Demonstration Program), is o develop actual construction and perating costs for the tag-on type eactor. The project would also demnstrate the feasibility and reliabily of the reactor for continuous opration of a boiling-water reactor perated in conjunction with a coal-ired superheater.

The Elk River Reactor is an inirect cycle natural circulation boilng water reactor. It will operate at thermal power of 58,200 kw, suplemented by a conventional 14,000-w coal-fired superheater. The output of the system is 225,000 lb/hr of team at 600 psig and 825 F at the urbine throttle. The net electrical utput of the plant is 22,000 kwe.

Using the indirect cycle, heat is ransferred from the reactor primary cooling steam to a secondary steam system by evaporator type heat exchangers. This gives the attractive tag-on feature to this type of facility in that the reactor system can be used to supply steam to turbines in an existing plant, without the concern of any radioactive contamination.

Each fuel element is made up of 25 pins of 304 stainless steel in a 5 x 5 array and filled with thoria-urania fuel pellets. One hundred and forty-eight fuel elements constitute the operating core. This is the first power reactor to use thorium for breeding purposes.

Transfer of fuel elements, between the reactor and fuel element storage well, is all done visually by raising the water level above the reactor vessel to the same height as it is in the fuel element storage well, and removing a gate and shielding plug between the two. This allows transfer of fuel elements in a vertical position and does not require a transfer chute between the two locations. This method of fuel transfer is quite simple and has proven to be very satisfactory.

Cleaning of Primary Piping

In working out a primary-system cleaning procedure it was necessary to consider removal of solid particles, such as loose weld beads, welding rod stubs and all dirt and grease that entered the piping after shop cleaning. In addition, the aluminum oxide blasting grit used in cleaning the type 304 stainless-steel pipe at the fabricator's shop contained an appreciable quantity of iron filings. When the inside of the pipe was blasted with this grit, some of the iron penetrated the pipe surface and, during shipping and installation formed iron oxide on the inside of the pipe; this oxide had to be removed.

An air blow was specified to remove loose solid particles from all primary piping at least 2½ in. in diameter, and a 4-percent solution of citric acid was specified for circulation for at least 4 hrs at 200 F, after which it would be neutralized to a pH of 3 with ammonium hydroxide and then circulated for another 4 hours at 200 F. The acid would remove the iron oxide, dirt and grease, and was to be followed by neutralizing and de-oxidizing treatment of hydrazine and morpholene.

A 500-lb air source was used to blow air for over 300 sec at least three times through each pipe. Although the piping was kept quite clean during installation, the air blow removed several small pieces of welding, weld-rod flux, and rubber balloon (used as damming for inert-gas welding), which could have hindered coolant flow through the core.

The acid cleaning appeared to be satisfactory as it was being done, and water samples taken at completion of the cleaning showed system solid impurities of only 1.8 ppm. It later became necessary to do some additional citric acid cleaning to remove iron compounds that were not completely flushed from the system in the initial cleaning.

The primary system was installed in accordance with ASME Code requirements and, because it was designed for 1250 psi, it was hydrostatically tested at 1875 psi. There was almost no leakage at this pressure; the only loss was through leaks around a few valve stems, which will be eliminated by adjusting packing pressure when the system is at operating temperature.

The 75-foot diameter, 115-foot high containment shell is specified to leak no more than 0.1 percent of contained volume in 24 hours at design pressure (21 psig). The final leak-rate test was made after all electrical, steam, water, and air penetrations were completed, using the reference chamber method (developed by Chicago Bridge and Iron Company, builder of the containment shell). This method uses leak-tight reference chambers distributed throughout the building and obviates air-temperature and temperature-distribution determinations in the building. The only problems encountered in preparation for the leak-rate test were in getting tight seals for the electrical penetrations, and in ensuring that the sealing rings around the emergency escape-lock closure shaft did not leak. As it developed, the rings had to be replaced.

In preparation for nuclear startup, 170 formal preoperational tests were conducted. These tests, and numerous informal tests and calibrations, permitted all components and systems to be checked out. Each formal test was conducted by an Allis-Chalmers engineer and witnessed by an AEC observer, and detailed results of each were recorded.

Power Costs May Decline

Current power costs from this plant, at 22,000 kwe on an equilibrium core, is approximately 10.01 mills/kwh. The system has been designed to operate at higher pressure and temperature, to permit future turbine-throttle steam conditions of 850 psig and 900 F. The reactor vessel and parts of the primary system have been designed for a reactor output of 116,400 kwt (twice the initial operating output).

uel element for the Elk River reactor consists of 25 pins made of stainless steel.

At Piqua, Ohio, this nuclear power facility is nearing completion, with startup expected early in 1962. River separates reactor facility from turbines in Municipal Power Plant.

Piqua Facility To Provide First Central Station Experience with Organic Coolant, Moderator

By JACK JACOBSON
Atomics International, Div. of No. Amer. Aviation, Inc.

The Piqua Nuclear Power Facility (PNPF), now in its last phase of construction at Piqua, Ohio, is the first central station nuclear plant to utilize an organic fluid as coolant and moderator. The reactor plant is designed to produce steam at 550 F and 435 psig at a rate of 150,000 pounds per hour at full reactor power level of 45.5-megawatts thermal.

The reactor facility, containing only the steam generating equipment, is located across the river and about 1,400 feet from the Piqua Municipal Power Plant, along the southeast edge of the city. Steam is piped across the river into existing turbines located within the Municipal Power Plant. The unusual length of line separating the boiler from the turbine required that oversized piping be installed to minimize pressure losses and also necessitated the transmission of the steam pressure at the turbine back to the control system within the reactor building.

To provide containment, the reactor and primary coolant systems are housed in a steel building lined with about 18 inches of concrete. The concrete in the interior of the hemispherical dome was applied over wire mesh by the guniting process. Because of the thickness and the large area, the application of gunite required about six weeks. During this time, very difficult working conditions were encountered in the lower levels of the building due to the rebound and high moisture associated with this process. Future reactors requiring shielding will probably utilize concrete on the outside of the dome to save time and money during construction. To provide leak tight integrity of the containment building, the thousands of electric wires that penetrate the shell must be sealed. Conventional bulkhead fittings are costly and the connections are subject to failure. The wires are sealed with a specially developed epoxy resin that has proved effective, simple and low in cost. The amount of ventilation air required for cooling of the reactor containment building was minimized by utilizing water-cooled electric motors to drive the two main coolant pumps.

The reactor contains 13 control rods which are of the unitized type, wherein the absorber elements and drive are located in a compact assembly. The entire unit is located within the reactor vessel completely submerged in coolant. The power leads for the magnetic jack drives exit through connectors in a nozzle of the reactor vessel. The vessel head is clear of any obstruction, and can be quickly removed for fuel changing operations. The reactor core is designed to accommodate 85 fuel elements which contain low enriched uranium alloy contained within bonded aluminum cladding and are circular in configuration.

Terphenyl, the organic coolant used, is non-corrosive, has a low volatility, and a high melting point, and is not difficult to contain in piping systems. Its non-corrosive nature has permitted the use of carbon steel construction for all piping and vessels and its low volatility at operating temperatures has allowed a design for an operating pressure of only 120 psia. To keep the coolant fluid, all organic containment piping is heated with 175 psig steam in steam tracing circuits. Excellent heat-up rates have been observed. Valves, packed with teflon in an extended bonnet, have given excellent service with 600-F coolant.

After completion of an initial preoperational and critical testing program, it is expected that the reactor facility will be in operation early in 1962, thus providing the first operating experience with a central station nuclear power plant cooled and moderated by an organic liquid.

Sodium Graphite Reactor At Hallam, Neb., Designed For Operation At High Temperatures, Pressures

By DR. EMERSON JONES, Consumers Pub. Power Dist.
and F. C. Gronemeyer, Atomics International, Div. of No. Amer. Aviation, Inc.

The Hallam Nuclear Power Facility program started in November 1957, and construction of the nuclear facility started in April 1959. It is now essentially completed, except for the radioactive waste facility which is scheduled for completion this month. Full power operation is scheduled to start in Sept., 1962.

Consumers Public Power District (CPPD) of Nebraska, which operates the HNPF for the AEC, started operation of the Sheldon Station conventional plant in June 1961, and Atomics International, a Div. of North American Aviation, Inc., is now proceeding with the check-out and preoperational testing of the nuclear steam generating facility.

The Hallam Nuclear Power Facility design incorporates a sodium-cooled, graphite-moderated reactor (SGR), and the HNPF program has as its goal "to demonstrate the economic and technical practicability of central station power utilizing a sodium graphite nuclear reactor, by operating the plant for the primary purpose of producing a maximum amount of electrical energy. . . ."

Hallam reactor bay, looking south from the intermediate heat exchange cell. Reactor loading face is in foreground, fuel handling machine is in background.

The HNPF will operate with higher reactor coolant temperatures, higher fuel element surface temperatures, and higher steam pressure and temperature than any other reactor currently authorized in the USAEC Demonstration Power Reactor Program. Sodium heat removal characteristics are excellent and permit high specific powers. Features of SGR concept are high specific power, low fuel cycle costs, low unit plant costs, and no obvious limit on plant size.

To meet their power requirements, CPPD plans that the nuclear facility will supply steam to the turbine presently installed with the fossil-fueled plant; subsequently, a second turbine-generator will be added for use in conjunction with the conventional boiler.

The reactor has a nominal full-power rating of 240 mwt. (This is the power required to produce a steam flow of 710,000 lb/hr at throttle conditions of 800 psig and 825 F.) New electrical output under these conditions is a nominal 75 mw.

The entire installation uses a single turbine generator operating on 850 lb., 900 F steam. Steam is being supplied by a fossil-fueled steam generator designed for 1800 lb., 1000/1000-deg., but by using the reheat section as an economizer, 850 lb., 900 F steam is produced. Superheated steam supplied by the reactor will take over the production load after the period of test operation. At that time, the fossil-fueled steam generator can be reconverted to 1800 lb. operation as a steam supply for a second turbine generator in a modern high-efficiency installation.

Included in the scope of the nuclear facility are the sodium graphite reactor, the sodium heat transfer systems, the sodium steam generators, the overall power-plant control system for nuclear operation, the nuclear fuel-handling system, and various auxiliary systems. The reactor is moderated with graphite and uses liquid sodium as a heat transfer agent. Slightly enriched uranium alloyed with molybdenum provides the initial fuel loading. Sodium, which becomes radioactive as it is heated in the reactor core, is pumped through three separate primary loops. Each loop has a heat exchanger in which the energy is transferred from the radioactive primary sodium loop to a non-radioactive secondary sodium loop. Each of the three secondary loops, containing non-radioactive sodium, has a steam generator in which feedwater is evaporated and the resulting steam is superheated. Steam from the three steam generators is fed into a common header which serves CPPD turbine-generators.

Several component systems, largely developed at Atomics International's Field Test Laboratory, service the plant.

Although the equipment design and layout required by combined nuclear and conventional plants caused real headaches to the architect-engineers, the effective combination of these two units has started to produce dividends.

For example, the mechanical problems associated with the startup of conventional facilities have been overcome and the operation and maintenance personnel will be able to devote greater attention to the reactor startup activities. In addition, the reactor startup program will benefit from having crews which have worked together as integrated units. Performance of auxiliary equipment such as pumps, valves, compressors, and heaters will be known and potential effects on the reactor system evaluated.

As the reactor construction approaches completion and the test operation program is being started, we continue to feel optimistic that this sodium-cooled system will produce the benefits of high efficiencies at reasonable costs. Economics should be improved with the flexible fuel management made possible by the plant capability of partial reloading of the core, of core balancing by adjusting coolant flows to each element at power and of selecting a variety of metallurgical forms of fuel which are chemically compatible with the coolant.

Saxton Reactor Plant Nears Startup For Operational-Type Test Program

By D. R. REES, General Manager
Saxton Nuclear Experimental Corp.

Construction on the Saxton Reactor Plant began in February of 1960, and the plant is now virtually complete and ready to receive fuel for its first core loading about November 15 of this year.

The liquid waste concentration facility, drum loading facility, gas compressors and the instrumentation and controls are all expected to be completed before December 1—well in advance of power operation. Currently, in a four-week period, plant systems are being operated at pressure and temperature using externally applied heat, major systems and control rod drive mechanisms have been given a functional test, instruments calibrated, alarm and scram settings adjusted and troubles corrected. About December 1, the plant is scheduled to be cooled down, the reactor vessel head removed and the fuel handling system tried out using dummy fuel elements.

Designed with a nominal rating of 20-mw (thermal), this small pressurized water type reactor steam generating facility has been planned to carry out a five-year operational type experimental pro-

View of Saxton reactor plant shows control and auxiliary building in foreground, vapor container behind it. Back of that is the gas discharge stack, next to which is the borated water storage tank. Structures to the right constitute the radioactive waste handling facility.

gram to be directed jointly by Saxton and Westinghouse staffs. Site for the project is a station on the system of the Pennsylvania Electric Co., one of the four General Public Utilities Corp. domestic operating utilities which formed the nonprofit Saxton Nuclear Experimental Corp. to operate it.

In September, Saxton representatives presented testimony to the AEC on the corporation's application for a provisional operating license, covering the startup program.

This program, which is expected to take approximately 6 months, includes the initial core loading, reactor criticality measurements, measurements of core behavior during stepwise approach to nominal rated power of 20 MWT, and further measurements during steady state operation at rated power level. We have not yet furnished AEC with a detailed description or hazards analysis of the experimental work which will follow the startup program. Authorization to conduct this later experimental work will be requested by subsequent amendment of Saxton's license application.

We did not request in our application for a construction permit, and we have not requested in our application for an operating license, any "allocation" of nuclear fuel, as has been customary for other power reactor projects. We have not thought it necessary to seek such assurance for the Saxton project. The quantities of fuel required for the Saxton reactor are relatively small, and we have no present plans for operating the reactor after conclusion of a five-year research and development program.

The safety features and protective devices designed into the plant are such as to protect against accidents in the event of operator error, though errors of this type have been minimized by careful selection and training of operator and key maintenance personnel and by use of detailed operating and test instructions and check-off lists. The more severe accidents which could be caused by human error involve the insertion of excess reactivity in the core through withdrawal of the control rods. Rod motion can be controlled by the operator. For example, during startup, the operator will maintain continuous manual control of the rods. However, the amount of control at the disposal of the operator is limited by safety features which have been included in the design of the control system.

In addition to these features, there are inherent control mechanisms in the reactor core. Failures of equipment or plant instrumentation which could occur are numerous, but those which can cause radioactive hazards are few and have been guarded against in the design of this facility.

Forestall Equipment Failures

Potential failures of equipment have been minimized through careful design, selection and purchase of equipment. These failures will be continually minimized by instituting an effective inspection and preventative maintenance program during plant operation.

The major equipment failures which could cause radioactive hazards directly are a rupture of the primary system or failure of the pressurizer safety valves. Other failures of equipment or controls may deactivate safety systems or represent hazards when simultaneous independent failures occur. The possibility of equipment failures has been taken into account in determining and analyzing the accidents which could occur.

The major reactor accidents considered were: (1) uncontrolled rod withdrawal during startup or at power, (2) uncontrolled heat extraction, (3) cold water introduction, (4) loss of chemical neutron absorber, (5) zenon burn-out, and (6) loss of coolant due to a pipe rupture. These accidents were analyzed for indications of core damage and for possible hazards to personnel on and off the site due to the release of radioactivity.

Ductile Materials Selected

In the design and construction of the Saxton Plant, the careful selection of ductile materials and design, construction, and testing techniques which are followed should preclude failures in large pipes similar to those mentioned above. Thus the rupture of the 12-inch primary piping is not considered credible.

It can be concluded that a loss of coolant accident is extremely unlikely and that clad and/or fuel meltdown would occur only if there is a complete simultaneous failure of the safety injection system.

The possible hazards associated with the major reactor accident that has been postulated are due to direct gamma radiation and inhaled radioactivity. The effect of deposition and external beta radiation from containment vessel leakage do not present a serious problem.

During the startup program, the Saxton personnel will operate the reactor under supervision of one or more of the Westinghouse licensed operators. The reactor will be operated essentially on a one-shift per day basis during the portion of this program that is carried out with the main coolant at ambient temperature. In order to expedite the training program, a second shift may be used during this phase of the startup program. The reactor will not be operated on a three-shift, seven day per week basis until a sufficient number of licensed personnel are available.

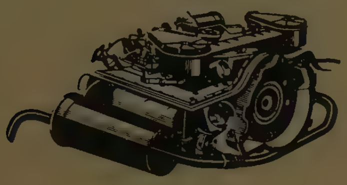
LOOK WHAT CHEVY'S GOT FOR '62...

MORE WAYS TO MAKE MORE MILES (AND MONEY)!

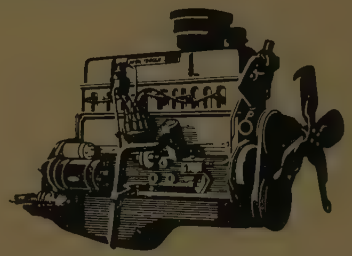
Matchless performers...matched to the job. That's what you'll find under the hoods of Chevrolet light-duty trucks for '62. More sure-saving power plants to choose from than ever before. New assurance of the *right* power for the job—power that does just what you want it to so that operating costs stay at a *low* low.

Standard in conventional models is the thrifty High Torque 235 Six, an engine that's powered more payloads than any other. *Then for heavier, harder working jobs that take more out of a truck, Chevy offers two great optional (extra-cost) engines for '62: the big High Torque 261 Six, available for the first time in this weight class, and the spunky High Torque 283 V8 with short-stroke design.*

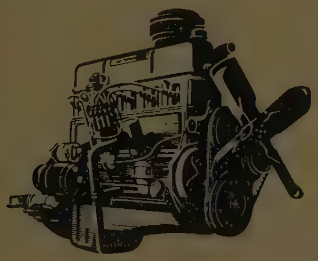
Add to this engine spread the space-saving High Torque 145 Six provided in Corvair 95 models and you've got a broad, all-purpose lineup that allows you to match the power to your type of work and nurse the last penny's worth of performance out of every operating dollar. Talk it over with your Chevrolet dealer soon. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.



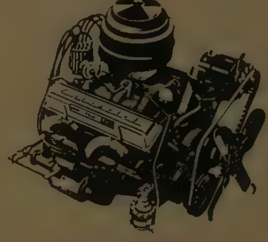
Compact High Torque 145 Six—air-cooled "pancake" design (only 17″ high) saves space and minimizes weight by eliminating water jacketing, radiator, coolant and water pump. Gone for good are antifreeze and cooling system maintenance expenses. With fuel-saving valve-in-head design, the 145 Six develops 80 hp and 128 ft.-lbs. of torque—ample for brisk performance with big loads.



Rugged High Torque 261 Six—you get extra torque (235 ft.-lbs. of it) for extra tough pulls, *plus* proved 6-cylinder economy—available for the first time in Chevrolet light-duty trucks. Provides 150 hp and scores of reasons for efficient, cost-saving performance—forged steel crankshaft, high-alloy inlet valves, precision bearings, hard-faced exhaust valves with Rotocoils, to name just a few.



Popular High Torque 235 Six—the most widely used engine in the history of hauling with 235 cubic inches of lean-muscled efficiency. Standard in conventional models, the 235 Six delivers 135 hp and a load-moving 217 ft.-lbs. of torque. Premium-quality features such as forged steel crankshaft, aluminized exhaust valves, oil-bath air cleaner, and precision bearings add to engine durability.



Efficient High Torque 283 V8—made to order for runs that call for the extra punch of V8 power. Advanced short-stroke design knows how to nurse extra power and miles out of every drop of gas. 160 hp and 270 ft.-lbs. of torque get big loads moving quickly and efficiently. Top durability features include chrome-plated piston rings, Moraine 100 bearings and hydraulic valve lifters.

CHEVROLET

AND SAVING AND SAVING AND SAVING AND SAVING

MANAGEMENT-MARKETING

EL&P Surveys Managers:

"Management Excellence" —Do Utilities Need It?

In the recent tenth annual Utility Management Workshop at Columbia University, Iowa-Illinois Gas & Elect. Co.'s Pres. Charles H. Whitmore challenged participants to ponder the question: "Do we need excellence in management in the public service industries . . . can we attain it . . . can we afford it?"

Regarding the participants from electric power companies as a good cross section of the industry's executive management talent on-the-way-up, EL&P repeated the inquiry through a series of questions asked in a post-workshop survey. Nine of the utility managers responded, and they represent six of the larger investor-owned companies of the country, mostly in the East.

As expected, agreement with Mr. Whitmore's premise was rather unanimous. In his presentation he observed: "I think we do need excellence in management, if we rest our conclusion on the hypothesis that the free enterprise system is worth preserving for those who come after us." And, he added: "We cannot afford to do without it; we can attain it . . . provided only that we place excellence in management high on the list of priorities for the conduct of our day-to-day lives as managers."

One of the respondents to the EL&P survey commented: "Attaining excellence in management will be a long, hard struggle." Another observed: "Electric utilities seem to be behind other industries in management development and progressive thinking. I think excellence can be attained, but management will have to take a hard look at itself and become less timid. Excellence is not a case of 'can we afford it', but in order for us to survive as a member of 'free enterprise' we *must* attain it."

In an extension of some of the key thoughts in Mr. Whitmore's remarks, EL&P posed these further questions and got answers such as those following:

Is the "Excellent Manager" typified by MORE than courage, competence, industry, integrity? What?

Nearly every respondent identified an additional quality he regarded as typical of an "excellent manager," with these being noted by different individuals: Common sense; keen perspective; aggressiveness in dealing with government bodies and the public; being well-versed in public and employee relations; possession of a reasonable desire to advance in the organization; personal identification with the company's business and objectives; having a sense of accomplishment, as well as a sense of responsibility for employee welfare; having an awareness of and a feeling for people as individuals. The manager who expressed the latter added: "A manager's job has been defined as 'getting things done through others' . . . and these 'others' are the people with whom he works."

Are goals and means toward them adequately identified in your organization? Are they written in understandable language?

Only three of the respondents (representing two companies) indicate that "goals and means toward them" are identified and written. (But, another man from one of these companies disagreed with his colleague.) Other replies ranged from the positive ("the goals ahead in my company are apparent, easily recognizable, but not stated in formal written fashion"; "company policy both written and unwritten, understood by all management personnel") to others who simply noted that goals are not stated in written form . . . and one respondent's flat "no." Representatives of two companies report that their organizations are in the process of "correcting this situation."

Columbia University's executive program in business administration in its tenth year, again attracted utility company executives. Sessions in recent weeks were attended by Robert O. Whitman, treasurer of American Elect. Power Co., Inc., and D. Bruce Mansfield, executive vice-president and general counsel of Ohio Edison Co., shown with Program Director Hoke S. Simpson (at right).

Is your organization aligned in such a way that all levels of management are delegated things of substance to accomplish, along with the authority to do what is necessary to accomplish them?

Four respondents answered "yes, generally so," while three more replied: "not entirely." Another reports: "Our organization is such that levels of management know what they are to accomplish, but we do not always have the necessary authority to accomplish them."

Do management people have enough freedom to make their own mistakes?

Five respondents say "yes;" two say "yes, with reservations;" one says "no." One other reports: "Division managers have more latitude and freedom of decision; however, in the general office, freedom is limited."

(Continued on page 57)

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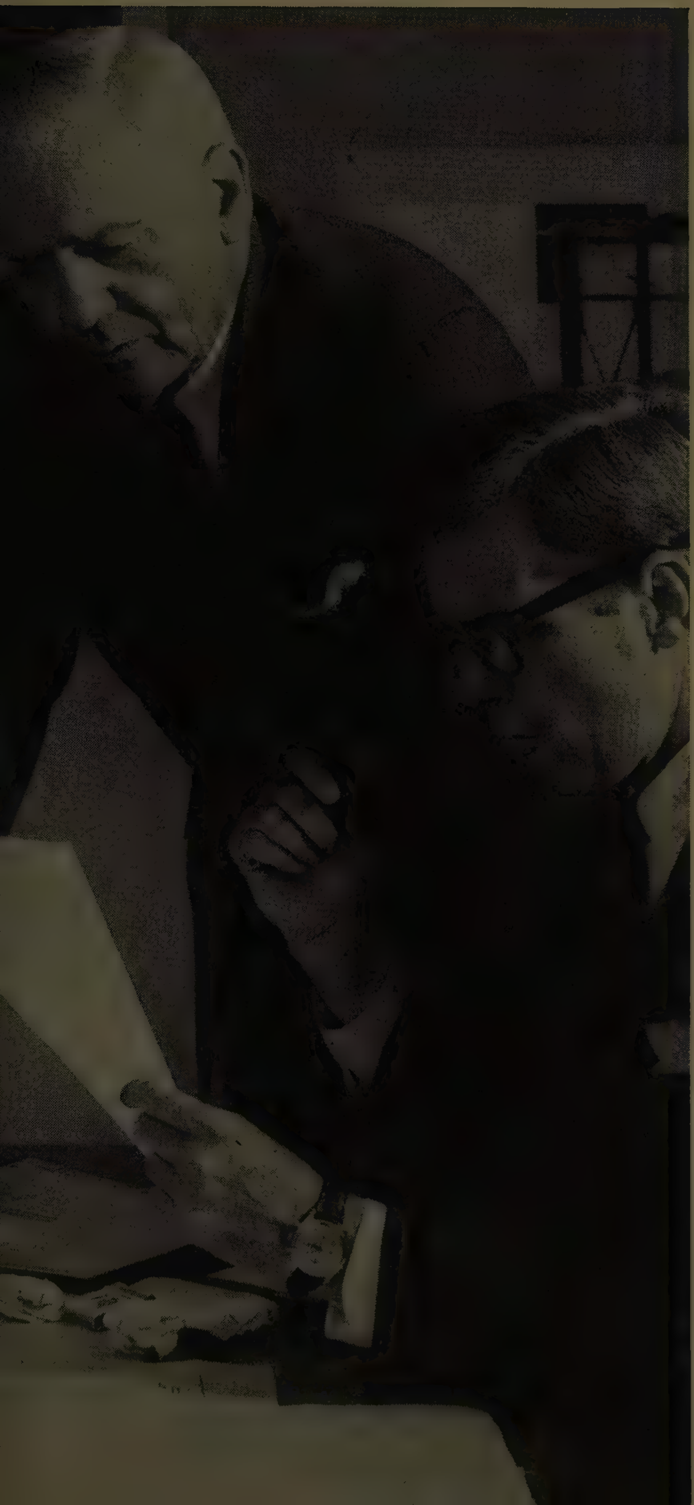
Why Moloney?

Because Moloney's philosophy of "Total Design" results in lower cost of use.



You know how *cost of use* can make the difference between transformers. Moloney puts great emphasis on the lowest possible transformer *cost of use.* To accomplish this, no one design feature is stressed at the expense of another. Instead, Moloney uses a "Total Design" philosophy which is important to you because it provides balanced design. This means fewer outages and efficient transformer operation, resulting in lower *cost of use.* Moloney's patented testing system assures the user that Moloney Transformers have successfully passed all tests and are electronically approved for service. Over the years this design philosophy will mean savings of many dollars per transformer.

When you purchase distribution transformers, be sure you consider the "Total Design" Moloney Transformer.

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MOLONEY ELECTRIC COMPANY

Manufacturers of Transformers and Switchgear for Utilities, Industry, and Electronic Applications

MANUFACTURERS-DEVELOPMENTS

Burroughs Corp. Enters Punched-Card Computer Field

Burroughs Corporation recently announced its entry into the punched-card electronic computer business, putting the company squarely into competition for the largest single bloc of the billion dollar a year market for automatic business data processing equipment.

Ray R. Eppert, president, said the company's program includes a new family of four solid-state computer systems, an expanded customer training program, a sizeable increase in the company's U. S. data processing sales and technical support force, and a manufacturing program that will utilize resources of four plants in Detroit and Pasadena, California.

The basic punched-card system in the new Burroughs B200 series—called the B260—was described by Eppert as a "workhorse computer" which will increase productivity significantly in medium and large-scale punched card applications.

"It is not a stripped-down version of a high-priced computer, but the first completely integrated, moderately priced system designed especially for the punched-card market," he said.

G. E. Announces New Rock Breaking Method

A new non-explosive method of breaking up rock with radio-frequency electrical power can make secondary blasting and explosive-breaking as much as 25 times more economical for the mining industry, according to test reports of the General Electric Co.

Known as electrothermal forcing, this process achieves in seconds mining operations that now take hours or days. It can be applied universally in such mining operations without danger to workers and with no need to interrupt working operations.

Westinghouse Develops Super Magnet

Scientists at the Westinghouse research laboratories announce one of the most sought-for goals of modern science: development of the first superconducting magnet. For its size, weight, and energy consumption it is said to be the most powerful magnet ever built.

Such a magnet has been vigorously sought in dozens of laboratories throughout the world. Until a year or two ago it was considered theoretically impossible to construct.

The size of a doughnut and only a pound in weight, the Westinghouse super magnet creates a magnetic field twice as strong as that from a conventional iron-core electromagnet as large as an automobile, weighing 40,000 pounds, and operated to saturation of the iron.

The superconducting magnet produces a magnetic strength, or flux density, of 43,000 gauss (43,000 lines per square centimeter).

New Building For S&C Electric

Ground at 6601 N. Ridge Ave., Chicago, Ill., has been broken for the eighth addition to the 12½ acre headquarters site of S&C Electric Company. The new building will house experimental mock-up and assembly departments. Participating in the ground-breaking are (from left) John Bever, general supervisor; John R. Conrad, president; and C. C. Martin, vice president.

Allis-Chalmers Uses Ammonia In Fuel-Cell Research

Research scientists at Allis-Chalmers are now using ammonia as a fuel in the company's continuing fuel-cell development program according to a report presented by the company at the recent annual meeting of the American Chemical Society in Chicago.

The experiments using economical, easily-handled ammonia as fuel in the cells that produce electricity through chemical reactions are the latest phase of the Allis-Chalmers fuel cell program. Earlier experiments used hydrogen, hydrazine, methanol and other fuels.

Advantages of the ammonia fuel cell, according to the report, are that ammonia is low in cost when purchased in large volume, and is easily condensed. Storage, transportation and handling techniques already have been worked out for ammonia used in large quantities.

Hubbard-Kearney Laboratory Available for Research

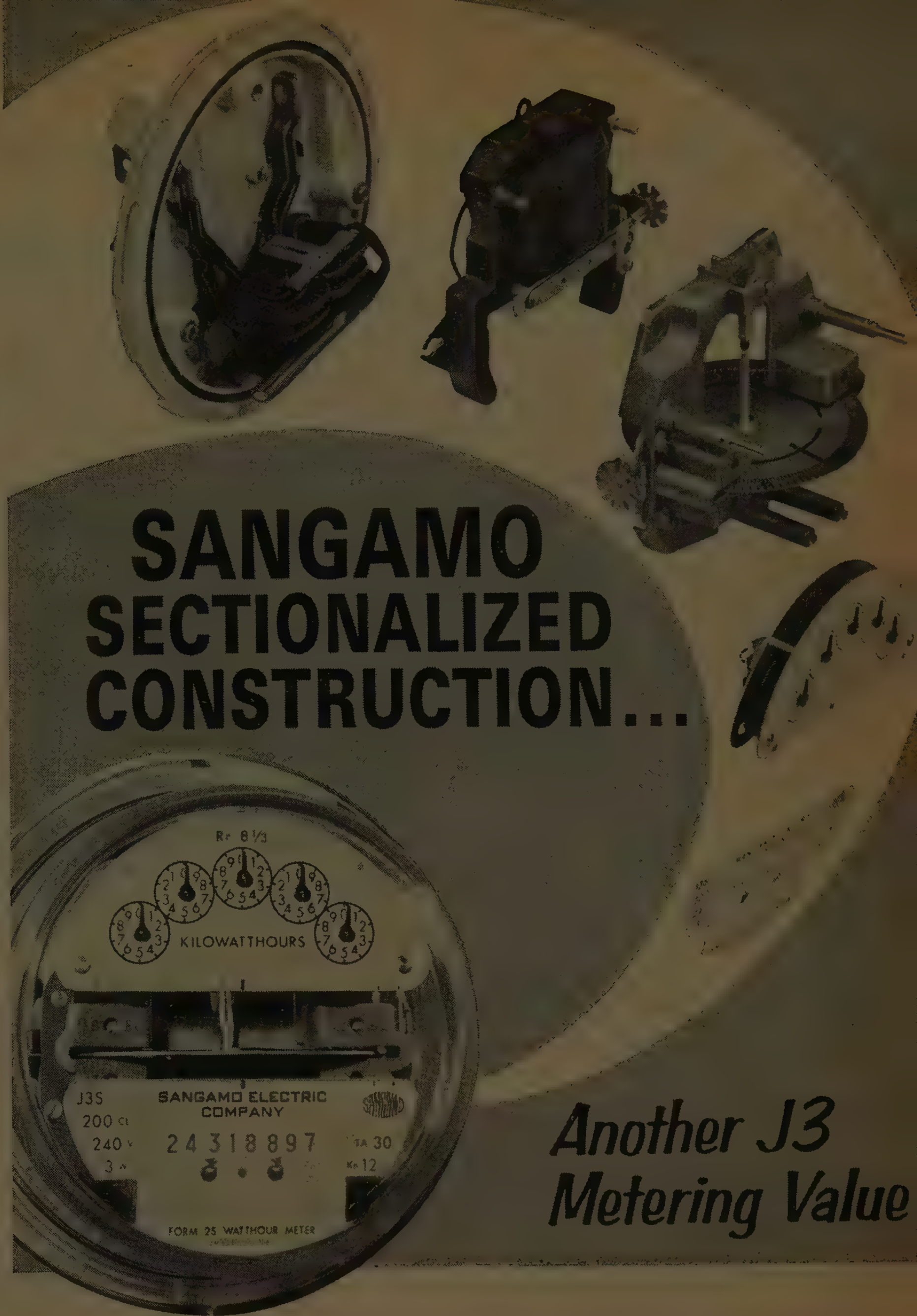
A portion of the master console, which controls all of the major equipment in the Hubbard-Kearney Electrical Research Laboratory, is shown here.

The Hubbard-Kearney research laboratory near Chicago recently has been made available to the entire electrical industry for development testing of utility products. Laboratory facilities are offered to utilities which may wish to have certain tests performed for them on an impartial basis.

According to A. C. Westrom, director of the laboratory in McCook, Ill., rates for testing will be based upon the equipment in use, plus actual labor for operation, plus the cost for expendable equipment.

230 KV 2000 Amp Air Switches Installed At Alamitos Station

Shown above during construction is one of twenty 230 kv, 2000 amp center side break disconnecting switches recently manufactured by The Cole Electric Company for The Southern California Edison Company at Alamitos Steam Station. These switches are rated 1050 kv BIL, 70,000 amp momentary. It is believed that these switches are the first of their type of this rating to be manufactured in this country.



SANGAMO SECTIONALIZED CONSTRUCTION...

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INDUSTRY IN CONFERENCE

Utilities Urged To Make Profitable Sales

Utilities must help build earnings with profitable sales and do everything possible to prevent further encroachment of Public Power.

This was the message of John F. Childs, Vice President of Irving Trust Co., in addressing more than 70 utility sales executives at the 25th Annual Ebasco Client Companies Marketing Conference held in New York last month.

Even many utility employees don't understand the difference between public and private power companies, said Childs. Utilities must get their customers to understand the job they are doing so that they may be able to get rate increases when they are necessary. A six percent return is now too low. It should be between six and seven percent or higher, he added.

John D. Wilson, Vice President in charge of economic research for Chase Manhattan Bank, predicted a continuing upturn in the nation's economy through 1962. The Gross National Product, now running at an annual rate of about $525-530 billion, may well approach the $565-570 billion level by mid-1962, barring any serious deterioration in the international situation, he said. Spending for plant and equipment—now less than in 1957, despite a higher economic level—will step up next year. Outlays could total $40 billion or more in 1962 compared with about $35 billion at present, Wilson predicted.

According to W. L. Byrne, Ebasco's Director of Utility Marketing and General Chairman of the Conference, successful selling and advertising efforts will mean little unless we succeed in creating a climate of public opinion which will permit our companies to operate freely and efficiently. We cannot be successful in persuading people to buy, unless first we have been successful in developing favorable attitudes toward our companies and our services, he said. Unlike other industries, most of a utility's public are its customers. What they feel about the company and the industry can influence their inclinations to buy more appliances, to use more service or to prefer your kind of service to a competitor's, he said.

Many utilities fail to treat public relations as a basic business function—as essential to the successful operation of a utility enterprise as accounting, engineering, rates and even sales, said R. R. Cahal, Jr., Marketing Consultant, Ebasco Services, Inc. If the investor-owned utility company is to attain the strong position in public relations, it must do so with a *planned* program—as fundamental in its operation as a plant maintenance program, a safety program, or a sales program, he asserted.

Gordon Defoe, general sales supervisor of The Washington Water Power Company, described some of his company's PR techniques using the average company employees. Hugh Isley, vice president in charge of sales, Carolina Power & Light Co., told the group how his company works with the press on publicity and news stories. George H. Marks, Director of Community Promotional Activities for Con Edison, described Con Edison's Community Promotional Activities Program. O. G. (Red) Carlson, general commercial manager, Texas Electric Service Co., demonstrated his company's "Block" technique in getting various city and town governments to approve new rates. Frank G. Smith, General Sales Manager, Mississippi Power & Light Co., told the Conference some of the things his company has done to maintain its image as a "good citizen" and as one of the largest corporations in the state.

Despite the excellent record of growth it has achieved within the past decade the utility industry must increase its marketing creativity to meet the competitive challenges of 1962 and the years ahead, in the opinion of Harold F. Smiddy, vice president General Electric Co. Utilities must pattern their sales techniques on the highly creative selling practices of the 1930's, he said. Selling opportunities in 1962 and the rest of the decade are tremendous. Technological changes, the exploding and changing population patterns and the expanded purchasing power provide new and real opportunities for greater sales of utility service, Smiddy added.

Some of the Ebasco speakers were (left to right) M. W. Larinoff; W. L. Byrne, Conference General Chairman; H. H. Scaff; and R. M. Wood.

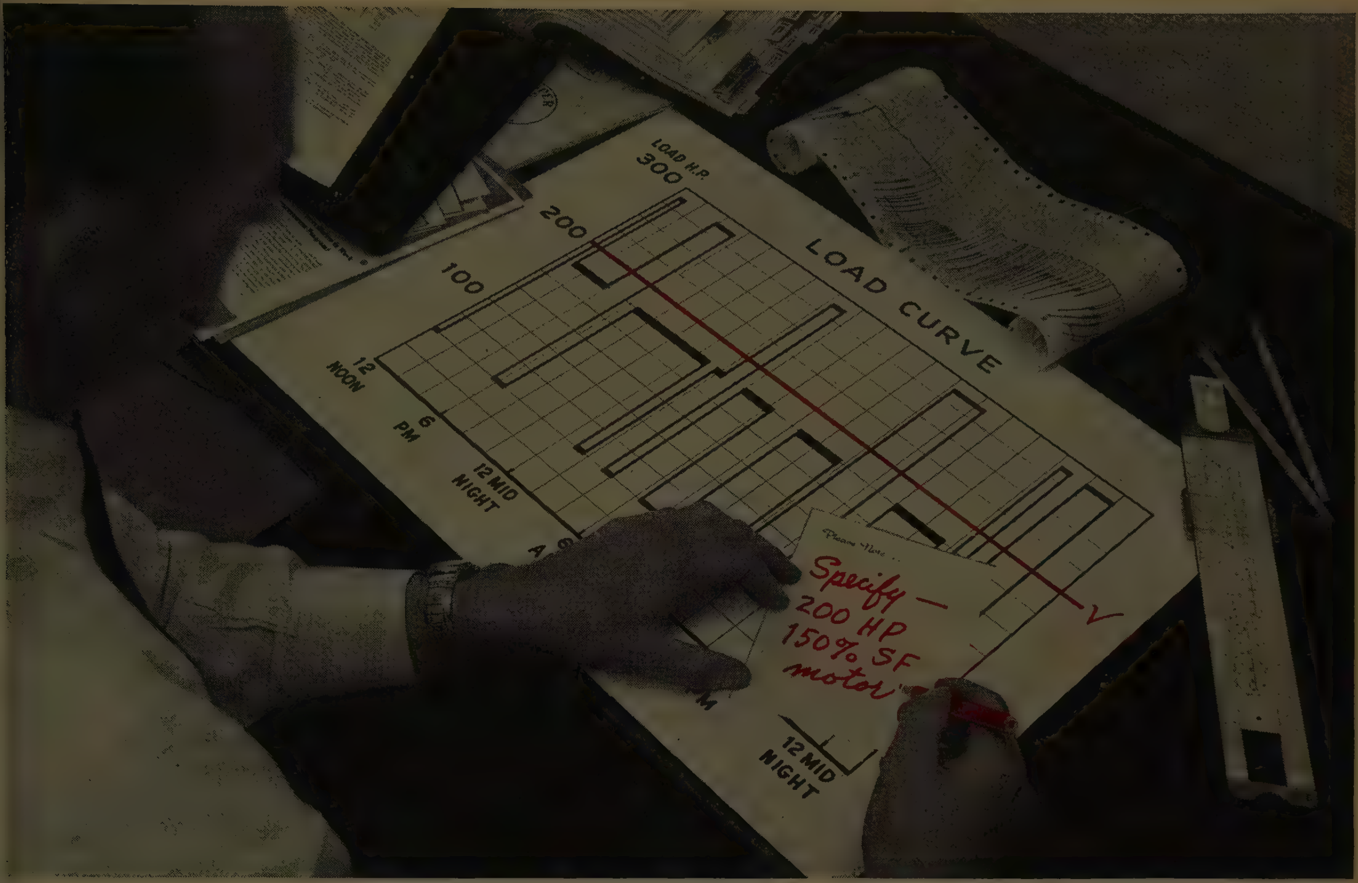
EEI Industrial Relations Committee Probes Responsibility at 14th Annual Conference

More than 300 industrial relations, and line and staff operating personnel heard utility company executives break down the problem of responsibility in the areas of manpower cost, self-security, leadership, and management development at the recently held 14th annual conference of the Edison

(Continued on page 55)

SILICONE NEWS from Dow Corning

Over-motoring Out-moded



Specify horsepower for nominal loads, Service Factor to handle the peaks!

Specifying motors with nameplate horsepower rated for peak load conditions is rapidly being out-moded as too expensive.

Today, it's far more economical . . . and just as reliable . . . to specify silicone insulated extra service factor motors with horsepower ratings based on nominal load conditions.

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Where does this additional capability come from? It's the hidden horsepower in the higher service factor rating! It's the result of the exceptional thermal stability of silicone insulating materials.

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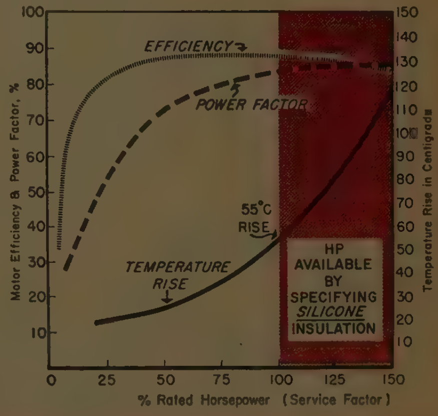
Top efficiency is obtained under normal load since the motor is operating at its designed horsepower rating most of the time.

Additional savings in several ways: additional nameplate horsepower is usually more expensive than the extra service factor silicone insulation provides; additional horsepower requires extra floor space and heavier mountings; over-motoring power factor problems are eliminated or minimized.



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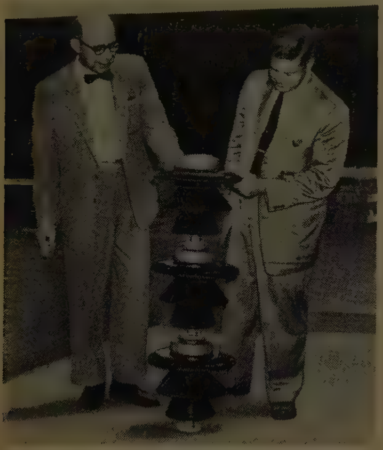
NEW PRODUCT DESIGN

I-T-E 3" Bolt Circle Insulators

Substantial cost, installation and maintenance savings, according to the company, are provided by all-new switch and bus stacking insulators which have been introduced by **I-T-E Circuit Breaker Company's Victor Insulators Division.**



The new royal blue switch and bus insulators are now available to switch manufacturers, substation erectors, and utilities.

Two units serve for all applications ranging from 115- through 161-kv at 450- through 750-kv BIL. This is an added advantage in that utilities with multiple BIL requirements can cover them by stocking only two sizes for this wide range of applications.

For any given BIL rating, the insulator units in a stack are identical. High strength alumina porcelain provides a greatly improved safety factor.

Circle item #1 on reply card

Self-Contained Capacitor Equipment

Self-contained Autotrol capacitor bank, providing power factor correction and voltage regulation at or near the load, and complete with built-in lightning arresters and fuse protection is offered by the **Westinghouse Electric Corp.** Rated from 150- to 1200-kvar, the new unit can handle fault currents up to 4000-amp symmetrical, limited only by 100-amp fuse ratings.

The Autotrol capacitor offers substantial savings over conventional equipment, the company says, in that the unit's CXP fusing costs less than one-third of fusing with open type.

Installation cost is reduced because a separate crossarm is not required for mounting protective equipment; nor is there the expense associated with the installation of six separate protective devices, since the Autotrol capacitor is completely self-protected.

Maintenance for the self-contained Autotrol capacitor is identical to that used for CSP® transformers. The oil switches are tripped out and the bank is disconnected through hot line clamps for complete isolation and safety for maintenance work.

Circle item #2 on reply card

Yoke-Suspended Bucket

Use of a yoke-suspended bucket gives the new Holan MV-50 Elbow 30 percent more working range than limited action aerial lifts with other types of bucket suspension, according to **Holan Corp.**

Holan defines limited action as less than 270 deg upper arm travel, 120 deg lower arm travel. Upper arm travel of the company's new model is 135 deg, lower arm travel is 85 deg.

The two-man bucket pivots on the center line of the center of gravity inside the yoke. This suspension design and sufficient upper and lower arm travel, coupled with continuous rotation, permits linemen to work over parked cars, over and between power and telephone lines and on the property side of the pole.

The parallelogram mechanical leveling system automatically keeps the bucket level in all working positions. The new Elbow reaches up to a 50-ft working height, out 30 ft on either side of the body. The two-man bucket will handle 450 pounds in all positions and is made of quarter-inch-thick molded fiberglass reinforced plastic.

Circle item #3 on reply card

New Lawn-Glo Luminaries

New traditional "Lawn-Glo" luminaires, inspired by lamps having their origin in seventeenth century Europe, are manufactured by **Line Material Industries.** They offer an authentic atmosphere of early America as well as an effective means of lighting yards and patios.

Prism panels provide a large area

f illumination particularly suited or lighting drives, entrances, and ecreational areas. Traditional Lawn-Glo luminaires are available n black and gold or white and gold, nd with their functional shape lend exceptionally well with home, atio, or garden, according to the ompany.

Circle item #4 on reply card

Plating Power Packs

Two new power packs specially lesigned for "table-top" electroplating have been introduced by **Selectrons, Ltd.** With these addiions to its standard model 2530, he company now offers sizes ranging from a lightweight portable unit to a large production model permitting simultaneous plating by two operators.

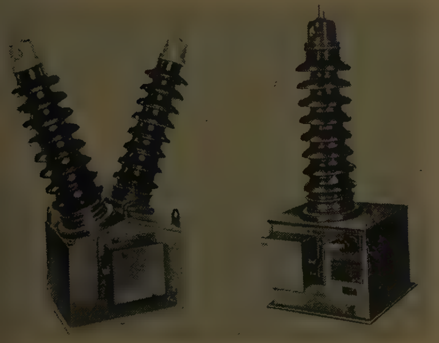
When used with special styluses and non-toxic metallo-organic solutions, a Selectron power pack permits quick, controlled electro-plating on specific, defined areas. A wide variety of metals—even alloys —may be deposited on almost any conducting material.

Components can be plated on-the-spot, often avoiding time-consuming disassembly and reassembly, without the need for large tanks of costly electrolyte.

Circle item #5 on reply card

New Potential Transformers

New line of oil-filled outdoor potential transformers (type APT) has been introduced by **Westinghouse Electric Corp.** They are the smallest and lightest potential transformers in the industry, the company says. Rated at 25- through 69-kv, 150- through 350-kv BIL, the units are suitable for metering or relaying applications and are available in single or two bushing design.



Circle item #6 on reply card

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MEN OF POWER

Sloan

The election of **Leonard Sloan** as assistant treasurer and assistant secretary of Jersey Central-New Jersey Power & Light Companies was announced by the electric utilities' Boards of Directors. Formerly, he was executive assistant to JCP&L-NJP&L's president, **Charles E. Kohlhepp.**

He joined JCP&L's Accounting Department in 1941 at Asbury Park. During his career he also served as administrative assistant to the sales vice president of both companies.

Before joining JCP&L he was associated with the New York Stock Exchange and also was employed by the Sao Paulo Tramway, Light & Power Company of Brazil.

* * *

Paul G. Whitmore, formerly electrical engineeer with Ebasco Services, and well known in the Mississippi Power & Light organization, has been elected vice president of Middle South Utilities, Inc. He will represent Middle South in matters concerned with system engineering and construction.

* * *

Gilkeson

Robert F. Gilkeson has been elected vice president in charge of engineering and research, Philadelphia Electric Company. He was, formerly, manager of the engineering and research department. He has been associated with the utility since 1939 when he joined the Company as a junior engineer. After he returned from World War II military service with the rank of major in the United States Army, he was assigned to positions in the electric generation department.

In 1951 he was granted leave of absence to join the atomic power division of the Westinghouse Electric Corporation. On his return in 1953 he was named assistant superintendent of generating stations, and in 1956 superintendent of the company's Eddystone electric generating station.

* * *

Charles T. Fisher, III, assistant vice president of the National Bank of Detroit, has been elected a director of The Detroit Edison Company.

Following completion of his formal education, he joined the accounting firm of Touche, Ross, Bailey and Smart. He became a Certified Public Accountant in February, 1957, and was elected to his present position with the National Bank of Detroit in June, 1958.

* * *

McNeer

Charles S. McNeer has been promoted to manager of electrical engineering at Wisconsin Electric Power Company succeeding **Willard S. Wilder** who has retired. Mr. McNeer joined the Company in 1950. He advanced through engineering positions in the system and operating groups; was named assistant manager of electric operation in 1958 and assistant manager of electrical engineering last October.

* * *

The appointment of **James L. Shoemaker,** formerly the company's director of market research, to director of public relations for the Florida Power Corp. was announced recently. This department, formerly directed by the late **J. K. "Pat" Flanagan,** has responsibility for the cultivation, maintenance, and improvement of the company's relations with its many "publics" which include customers, employees, suppliers, dealers and stockholders.

Mr. Shoemaker joined FPC in 1955. His experience includes more than 20 years in the fields of economic and market research, and sales promotion with two of America's largest corporations.

* * *

Bitzer

C. E. Bitzer was recently appointed vice president, marketing for G&W Electric Specialty Co. He will be responsible for expanding and coordinating the marketing, sales, and advertising functions to meet the increasing demands for G&W power cable accessory and switchgear products in the rapidly growing utility and industrial markets.

With wide experience in marketing and merchandising electrical utility products, he comes to G&W from Anderson Electric Corp. where he rose in four years from distributor division sales manager to vice president, sales. Previously, he was associated with the domestic and international divisions of Westinghouse Electric Corp.

* * *

Appointment of **Jack D. Schwartz,** of Seattle, as assistant to **D. B. Leonard,** Washington division manager for Pacific Power & Light, was announced recently by the company.

For the past five years, Mr. Schwartz has been assistant director of public relations for Washington Natural Gas Company. He has been active in the Association of Washington Gas Utilities and the Pacific Coast Gas Association, and has served as Chairman of the civic affairs committee of the Seattle Chamber of Commerce.

* * *

Robert E. Pile recently succeeded **C. B. Ayars** as manager of Northern States Power Company's Grand Forks division. Mr. Ayars is retiring after nearly 45 years of service with Northern States Power Company.

EI CONFERENCE

—*from p. 48*

lectric Institute's Industrial Relaons Committee.

After a welcoming address by hairman C. E. Parker, Commonealth Edison Co., the first keyoter, F. L. Larkin, vice president f Wisconsin Electric Power Co., sked the question, "Cost of manower—whose responsibility?"

He began with the challenge: We in the utility business have rown very smug about our indusry, which has what we refer to as built-in security' and 'built-in staility'." In a blunt comparison, he aid, ". . . but long-term studies in ther industries show that the effeciveness of the human being, as uch, has been steadily diminishng, at least since World War II, nd if that is true in the highly ompetitive industries where such tudies have been made, it is cerainly true in our built-in secure nd stable industry.

". . . The most serious, I believe, s the absence of rough-and-tumble, ut-throat competition from other suppliers of the same or similar ervice to the same customers, of igher quality or at a lower price. In a free enterprise system, competition is the greatest single source of improvement. We lack the incentive and are, therefore, largely dependent upon motivation from within our own organizations. Do we have the motivators where they are needed? If so, who are they?"

Emphasizing the importance of the specialist, Larkin said, "The most efficient segments of modern industry have, of necessity, developed an increasing number of staff specialists. Utilities, in general, have been slow in pursuing this trend, at least in the industrial relations area where the human element of the business is the raw material with which we work. We need many different kinds of specialists and more of them."

A. L. Clark, Personnel Manager of Virginia Electric Power Co., dug into the all-important question, "Self-security — whose responsibility?" In his beginning remarks he said, "Any system or program which by design is intended to remove from the individual his responsibility for self-security, which encourages him to shirk this re-

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sponsibility, or which enables him to shift his responsibilities to others, can result only in utter waste of human assets, and the loss of human dignity and self-respect."

In pointing up company responsibility, he said, "Notwithstanding the fact that the individual is responsible for his own security, social and corporate groups today feel a moral obligation, and perhaps a business and social obligation, to encourage and assist the individual in his search for self-security.

"Of all the security which man strives for today, none is more important or beneficial than that which he seeks through God. In his own way he finds this security—no one else can find it for him. Many things encourage him by opportunity and example to seek and to sustain this security, but the responsibility still belongs to the individual."

Clark expressed the idea that even though self-security is the individual's responsibility, the company is "rightfully a partner in such security.

". . . Surely times change, conditions change, and there is need for changed thinking, but actions which lead to abandonment by the individual of his responsibility for his own security are to be avoided if there is to be a survival of the individual as such," Clark concluded.

After defining "first line supervisor," F. M. Osta, vice president-employee relations, Niagara Mohawk Power Corp., presented his analysis of the question, "Leadership by first line supervisors—whose responsibility?" Osta specifically concerned himself with the task of distinguishing between individual and company responsibility in developing and exercising leadership qualities on the part of the first line supervisor. He then defined leadership as the art of influencing human behavior—the ability to handle men.

"The art of influencing behavior," he said, "the very essence of leadership, in turn involves understanding, analyzing, predicting, and controlling men's behavior. Also involved in successful leadership is the *will to lead* together with the character which *inspires confidence*."

Indicating his disbelief in the theory that leadership can only be inherited, Osta remarked, "Leadership is intangible only to the extent that we make it so. Any reasonably intelligent, morally sound, forceful man, however experienced can become acquainted with the principles of leadership."

Over all, Osta emphasized that the first line supervisor "*will be unable to turn in an effective performance unless the organization of of which he is a part provides the atmosphere, climate, conditions and inducements that are necessary to achieving such a result.*"

Keynoter, R. H. Sessions, personnel director, Idaho Power Co., addressed the conference on the subject, "Middle Management Development—Whose Responsibility?" In an effort to stimulate more accurate thinking, Sessions broke down the subject into specific questions which ranged over the needs of management, the development of middle management, selection of individuals, measurement of performance and environmental conditions.

"How can we develop middle management people," he said, "unless we first know what our needs are? Certainly we must train people to replace those middle-management people we know are going to retire or quit, and we must also upgrade the present performance of those middle-management people now on the job."

Concerning the development of middle management, Sessions remarked, "If we adopt the idea of letting the cream come to the top as a policy of middle management development, perhaps we should first be sure that the cream is there. If it isn't there, we had better adopt a different idea."

In his conclusion, Sessions stressed the importance of human relations. "Basically," he said, "I feel that if there is going to be a survival of our business and industry as we know it today, there must be a new approach and greater importance attached to the human relations training that candidates for management are exposed to . . . Of equal importance there must be an upsurge in understanding of the part that the study of human behavior can play in avoiding costly mistakes in management development."

Is there periodic evaluation and review of management performance—adequate to aid in developing management people?

Representatives of one company simply reported "no," noting that an annual merit rating program was dropped several years ago. One responded "yes, to a degree;" while representatives of three other companies indicated that their organizations are making progress in this area. (But, another representative of one of these utilities comments: "My company has no formal program of evaluation and review, and the method presently used is not an adequate aid for developing management people."

Still another observes: "An evaluation of management performance is made annually at the time of consideration of salary revisions and at other times when promotions and transfers of management personnel are under study. While we believe that our periodic evaluations are adequate, it is difficult to determine such adequacy in developing management people as many factors besides an evaluation enter into the process of developing people."

Mr. Whitmore asked his audience at the Columbia University Workshop: "What can you do about management 'excellence'?" and, he proposed that the participants (1) make a complete analysis of the organization for which they work and (2) develop a written set of personal goals.

One respondent says: "Such an analysis has been made; the set of goals should and will be developed." Another called the first suggestion "not practical nor necessary," but labeled the second suggestion "practical and feasible." Another said an organization analysis is "fine if one is in a level of management where he has direct contact with the top level;" and warned that lack of a written set of goals "may lead to stagnation."

Another: "Since returning from Arden House, I have attempted to initiate a program for the Company along the lines of management development. A program such as this does not exist in our organization at present. Some progress, I believe, is beginning."

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Kansas City Service Drop . . .

Kansas City Power & Light Co. has designed its own single-cable service drop wire—and expects to use one-million ft per year. Rated at 600 volts, the Kansas City Service Drop consists of two parallel hard-drawn aluminum conductors covered with neoprene and bound together in a wrapping of aluminum ribbon which serves as the grounded neutral conductor as well as the cable jacket. Surface of spiral-wrapped aluminum ribbon provides a rasping action which makes the cable essentially self-clearing in trees.

Engineers at Kansas City Power & Light list neat looking, easy to install among advantages offered by their single-cable construction. It can be run directly to the meter, thus eliminating dead-ending and splicing where the drop wire meets the house. In addition, the construction reduces chances of power theft and virtually eliminates contact hazards to employees and the public.

World's First Package-Type Gas Turbine Plant . . .

South Carolina Electric & Gas Co. recently installed the world's first package-type gas turbine plant at Beaufort, S. C., according to S. C. McMeekin, President of the Company. The 11,250-kw unit will be used chiefly for emergency conditions and "peaking" purposes, McMeekin stated and it can be turned off and on from SCEGCO's central dispatching office in Columbia.

It is the first of four units which SCEGCO is buying from General Electric Co., developer of the plant. A second unit has been sent to Charleston, and the other two will be placed later.

First Digital Computer-Directed Economic Dispatch Control System Put Into Service

A computer-directed control system developed jointly by Minneapolis-Honeywell Regulator Co. and Philadelphia Electric Co. was placed in service recently and represents a major advance in the application of automatic control for the economic dispatch of electric power.

For the first time, high-speed analog control elements are joined with an industrial process digital computer, the Honeywell 290, to perform the primary function of assigning generation at minimum incremental cost.

Of significance also is the solid-state design of the system in which the only moving parts are relays. Conspicuously absent are motors, servos, slidewires and vacuum tubes.

By the end of the year, most of the 34 generating units at nine power stations—27 driven by steam turbines and seven by water—are expected to be under automatic load control of the computer-directed system.

This jointly-developed control system is certain to produce operating economies by providing more efficient generation and distribution of electric energy, according to Honeywell Vice President James S. Locke.

Once the total generation level is determined, and initial allocations are made to controlled generating units, the computer will sample desired steam generation every 10 seconds, calculate new economic allocations and sequentially set these values on control amplifiers to obtain the most economical loading.

Right, looking over one of the register packages—temporary storage units for programming changes—are J. R. Stauffer (left), Philadelphia Electric and J. W. Hoag, Minneapolis-Honeywell, project engineers of the jointly-developed computer-directed dispatch system.

Left, describing the new Minneapolis-Honeywell Computer Console to members of the press recently in Philadelphia Electric Co.'s Dispatching Room is H. R. Koen, Minneapolis-Honeywell engineer.

CALENDAR OF EVENTS

Nov. 1—EEI Insurance Committee Meeting, Tides Hotel, St. Petersburg, Fla.

Nov. 1-2—PEA T&D Committee Meeting, Shenango Inn, Sharon, Pa.

Nov. 6-7—EEI Sales Personnel & Training Committee, New York, N. Y.

Nov. 6—AIEE Western Appliance Conference, Biltmore Hotel, Los Angeles, Calif.

Nov. 6-8—EEI Accident Prevention Committee Meeting, Tutwiler Hotel, Birmingham, Ala.

Nov. 6-9—Atomic Industrial Form, Atom Fair, Conrad Hilton Hotel, Chicago, Ill.

Nov. 7-9—American Nuclear Society, Chicago Meeting, Conrad Hilton Hotel, Chicago, Ill.

Nov. 7-9—Eighth Industrial Electric Exposition, Penn-Sheraton Hotel, Pittsburgh, Pa.

Nov. 8-9—EEI Commercial Cooking & Water Heating Committee, New York, N. Y.

Nov. 9-11—PIP National Youth Conference on the Atom, The Palmer House, Chicago, Ill.

Nov. 13-17—NEMA Annual Meeting, Traymore Hotel, Atlantic City, N. J.

Nov. 14-15—EEI Eighth Annual Area Development Workshop, DuPont Plaza Hotel, Miami, Fla.

Nov. 15-16—SEE Sales, Advertising & Public Relations Conference, Tides Hotel, St. Petersburg, Fla.

Nov. 27-28—EEI Commercial Lighting Committee, Rochester, N. Y.

Nov. 26-Dec. 1—ASME Winter Annual Meeting, Statler Hilton Hotel, New York City, N. Y.

Nov. 30-Dec. 1—EEI Electric Space Heating and Air Conditioning Committee, Pittsburgh, Pa.

Nov. 30-Dec. 1—Institute of Radio Engineers, National Conference on Vehicular Communications, Radisson Hotel, Minneapolis, Minn.

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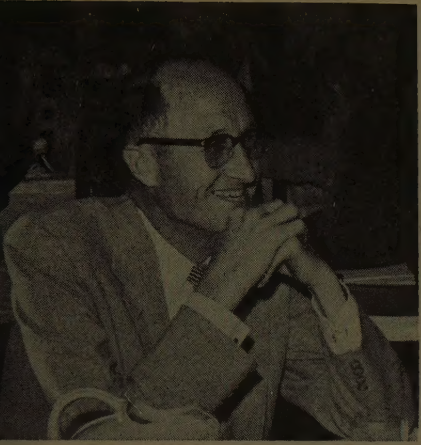
LIGHT AND POWER LINES



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THE MAGAZINE OF ELECTRIC • UTILITY TECHNOLOGY

Little Cars Make Big Savings—As electric utilities expand their use of compact cars and trucks, evidence mounts that very substantial savings are being effected.

One utility, Houston Lighting & Power Company, reports that compacts cost about $10,000 less to operate for each 1,000,000 miles driven. As expected, the biggest savings have been found to be in the original costs and fuel. Compacts average 22.55 miles per gallon while standard cars in the Company fleet average only 16.73 (1960 figures).

This Company has 720 passenger vehicles and trucks in its fleet, and purchases on the average one passenger car weekly. Passenger cars remain in the Company for about four and one-half years, accruing 70,000 miles. The Company now has one of the largest compact fleets in the Gulf Coast Industrial Complex.

A most surprising savings reported by this same Company has been in tire wear. The compacts are getting better tire mileage than their larger cousins (approximately 25,000 miles per tire), lowering tire cost.

No less surprising to this Company were their results from switching to a pool system at about the same time the compact car program was started. Pool cars were driven 800,000 miles last year. The biggest argument raised against the pool system was that drivers would be driving cars with which they were not familiar as they had been when cars were assigned, and consequently the accident rate would skyrocket. Conversely, it plummeted. Last year the Company's passenger cars were involved in only 1.09 accidents per 100,000 miles, as compared to the national figure for electric utilities of 1.34 per 100,000 miles.

Constant increase in utility jobs requiring transportation has resulted in very sizeable percentage increases in utility fleets. As an example, the Ohio Edison Company's fleet has increased 23 percent in the last ten years; from 533 in 1950 to 655 in 1960. The mileage rolled up last year on this Company's autos and light trucks was just shy of 12-million miles.

Ohio Edison has purchased 91 U. S.-made compacts in the past year and a half to permit testing them for economy.

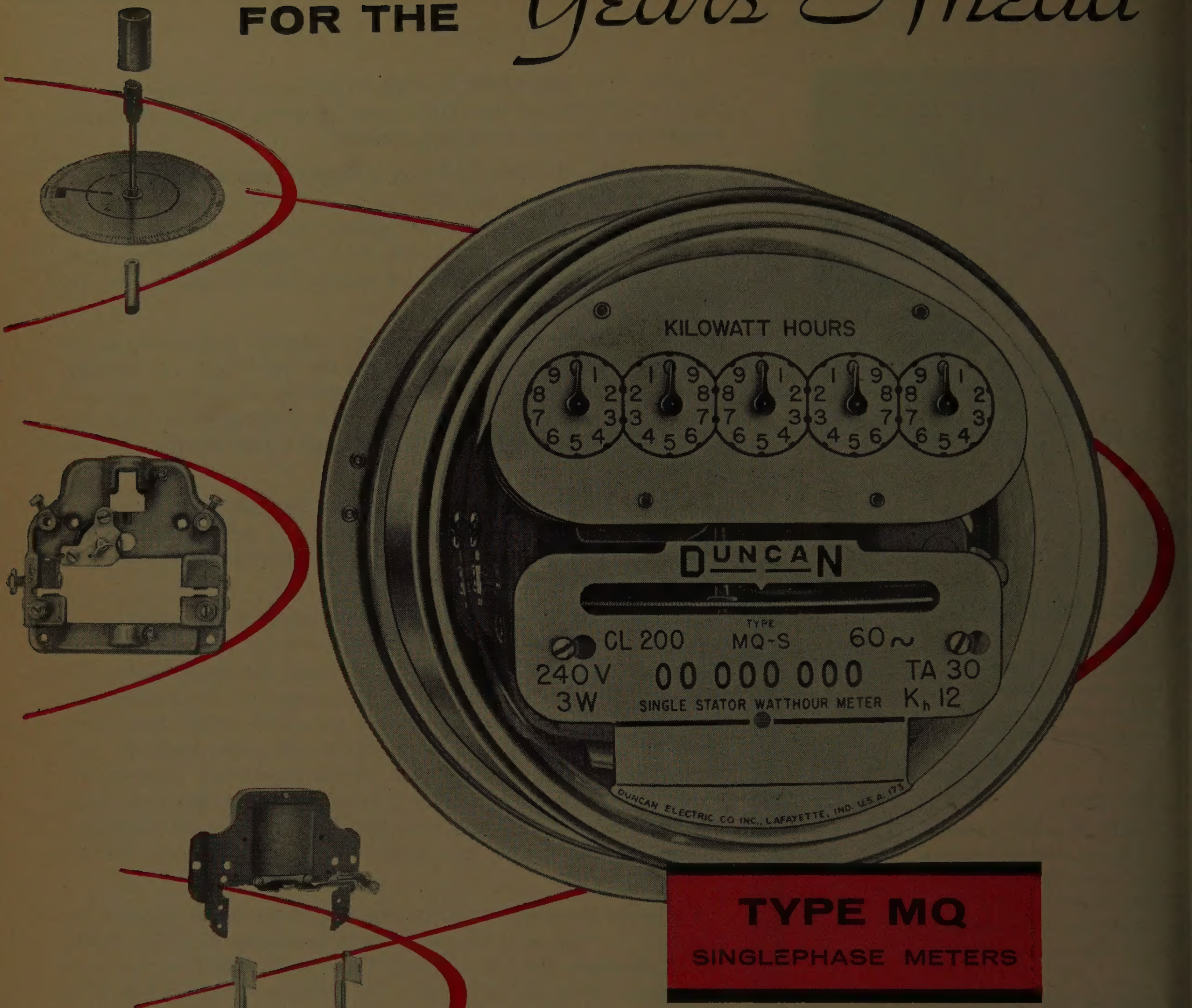
Compact trucks are expected to effect important savings to the Niagara Mohawk Power Corporation, which now has 40 in use throughout its system. Plans call for eventually replacing most service trucks with the new model.

An idea of the potential savings in gasoline mileage and maintenance costs, in addition to their lower purchase price, can be realized from the scope of Niagara Mohawk's service operations. Last year, 328 service trucks traveled a total of 3,300,000 miles in handling some 1,145,000 service calls and other assignments.

There seems to be no doubt that compacts are destined for a starring role in electric-utility fleet operations throughout the nation, bringing major savings in their wake.

Garrett
Publisher and Editor

FOR THE *Years Ahead*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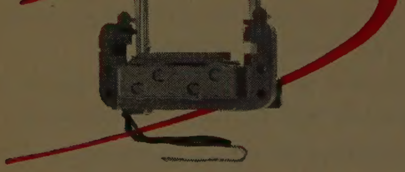

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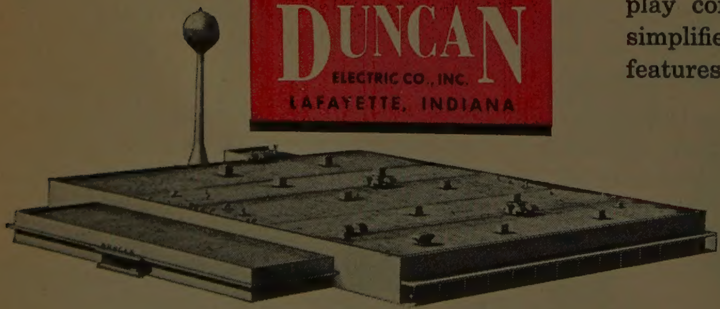

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